INDIAN AGRICULTURAL STATISTICS

(An Introductory Study)

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PREFACE

In 1934, I was associated with Dr. A. L. Bowley and Prof. D. H. Robertson in the economic enquiry conducted by them on behalf of the Government of India. The principal problem before us was the drawing up of a scheme for an economic census in India. This involved an examination of the nature and value of the existing economic statistics in the country, and as agricultural statistics form the backbone of the whole statistical framework of India, this subject was carefully gone into. I then realized the great importance of crop forecasts not only to the administrator and the businessman, but to the economist. As no detailed account of the methods employed in crop forecasting is readily available, it then struck me that a book on the subject would be useful. Soon after my return to Madras, I worked at the subject in collaboration with my colleague, Mr. N. Sundararama Sastry, Lecturer in Statistics, and the little book before us is the result.

The book is mainly concerned with the methods of crop forecasting and the processes involved, but it also gives a description of the Government publications on agricultural statistics. To the economist and the statesman, crop statistics are needed chiefly for the purpose of assessing national income and economic welfare. In the circumstances of India, the question whether production, especially of foodstuffs, has been keeping pace with population is also important. Therefore these subjects have been dealt with in this book in the last two chapters.

We are grateful to the Syndicate of the Madras University for publishing this book. Mr. A. R. Sinha, of the Department of Commercial Intelligence and Statistics, Calcutta, read through the first four chapters and gave us useful suggestions. Dr. D. W. Dodwell, I.C.S., went through some of the chapters in proof and made some improvements. Mr. K. C. Ramakrishnan and Mr. N. K. Adyanthaya have also assisted us in various ways. Mr. N. T. Mathew was helpful in drawing up the tables. We are thankful, to all these gentlemen, but none of them is responsible for any opinions set forth in this book.

Our thanks are also due to the G. S. Press for the great care taken in the printing of this book.

P. J. THOMAS.

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CHAPTER I

COLLECTION OF AGRICULTURAL STATISTICS IN INDIA—HISTORICAL

1. *What are Agricultural Statistics?*

Agricultural statistics deal mainly with the land used for agricultural purposes and the crops raised on it. Evidently, the crops form the core of the subject, seeing that they provide mankind with sustenance and play an important part in trade and business. In a self-sufficient rural economy, where each family raises the produce needed for its consumption, agricultural statistics are of little importance; but in these days of international division of labour, when many countries depend on others for the supply of the most essential foodstuffs and raw materials, agricultural statistics are of great practical importance. Thus Western Europe which specializes in industry and trade depends on imported supplies of wheat, meat, cotton and oilseeds from Asia and America. While these two continents are interested in finding markets abroad at profitable prices, European countries are even more keenly interested in knowing in good time the probable prices at which they can obtain their foodstuffs and raw materials. Recent tendencies have perhaps weakened the basis of international specialization, but so long as the natural differences between the different zones of the earth persist, specialization in some primary products is bound to continue.

Statistics of production form the most valuable commercial intelligence, provided they are accurate and published at the right time. The price of most primary products largely depends on the quantity actually in the market or likely to come into the market in the near future. Therefore, it is necessary to know the quantity of each product available at any particular time. For this purpose, it is not sufficient to count up the produce after the harvest. It is necessary to have a forecast of the yield well in advance of the harvest. Hence the importance of crop forecasts, and the prominent place they occupy in agricultural statistics. Accurate information about the total production during a period of time, say a year, is also necessary in order that national income may be correctly estimated. Especially in countries like India, agricultural production forms the bulk of the national income, and a measure-

ment of it is therefore of great importance for estimating total income and the quantities of foodstuffs and other produce available for consumption. Crops therefore make up the core of agricultural statistics; hence the importance given to them in this book.

2. *Agricultural Statistics for Revenue Purposes*

The collection of agricultural statistics began in India at an early date. As the bulk of public revenue in India has always come from the land, kings were generally interested in collecting statistics regarding land and crops and yields. The well-known work *Ain-i-Akbari* gives a sample of such statistics collected for revenue purposes.[1] British administrators in India realized the importance of agricultural statistics at an early stage. Where the zamindari system was adopted and the land revenue was settled permanently, as in Bengal, not much in the way of statistics was required, but when the Government proceeded to settle with the ryot (cultivator) on a temporary basis, they were committed to a system in which the collection of revenue depended on the maintenance of detailed statistics of land and crops. For, in the temporarily settled tracts, the land revenue demand is settled on the basis of net produce or net assets, and in order to calculate this, information about the cropped area, the costs of cultivation, the total yield from holdings, and grain prices for a series of years is essential.

The earliest of such (ryotwari) settlements was made by Colonel Read and his able lieutenant, Colonel (later Sir) Thomas Munro, in the northern part of the Salem District (then called the Barāmahāl) during the years 1792-1800. In making this settlement (called 'ryotwari'), they had to collect statistics of land values, costs of cultivation, crop yields and the prices of produce of various kinds for a number of years. The total area of the district had also to be measured. Actually, prices were collected from the days when Tippu ruled the country. Colonel Read also made some sort of a rough village economic survey. Price statistics were even more necessary in the *olungu* system of revenue assessment which prevailed in Tanjore and Tinnevelly till about 1854, as the revenue demand for any year was dependent on the price level of the previous ten normal years. When ryotwari settlements were later made in Bombay by Mr. Pringle (1824-28), similar statistics had to be

1. See Lord Meston's Address on Statistics in India—*Journal of the Royal Statistical Society,* 1933, pp. 1-20.

collected there also. In the United Provinces (then called the North-Western Provinces), the system adopted was different, but statistics of crops and costs and prices were necessary for settling the revenue demand. The result is that statistics of prices, land values, and cultivation costs are now available for many parts of India from the early nineteenth century. No doubt, the statistics then collected were defective in many ways, but with all their faults they are a valuable storehouse for the study of economic history. Not many countries even in Europe can claim to possess such an uninterrupted series of statistics. This is chiefly due to the fact that, in those countries, land revenue does not play such an important part in the revenue system as in India. But it must be admitted that the credit for this goes largely to the remarkable set of men then recruited to the Indian Civil Service. Those men were trained in the Haileybury College by teachers like Robert Malthus, and the voluminous records that they have left behind show that Indian civil servants of the time were intimately acquainted with contemporary works on political economy.

The primary data for all these statistics were collected by the village officers, chiefly the village accountant, called 'karnam' or 'patwari'. The village has had such officers from ancient times. The British reorganized the whole system. The patwari keeps the registers of the village and these form the primary source for nearly all the agricultural statistics of the country. Much has been said about the defects of the patwari's figures, and some of these will be dealt with in the next chapter. But it may be said here that no other agency would have performed such difficult tasks at so low a cost. At any rate, they are men with local experience and they cannot be easily replaced.

But the statistics thus collected for revenue purposes did not serve most of the other purposes for which such statistics are required to-day. They were not used for crop forecasting ; nor was such a thing known then.

3. *Growth of Agricultural Statistics*

After British India came under the Crown, the Government took upon itself wider responsibilities. The conception then came into vogue that the Government in India was in the position of the supreme landlord, and this influenced the State policy in regard to famine relief, irrigation, railways and agricultural improvement.[2]

2. Lord Mayo wrote : "The Government of India is not only a Government but the chief landlord. . . . The duties which in England are performed

In theory, indeed, British administrators still continued to be firm believers in *laissez faire*. Sir Bartle Frere and Sir Charles Trevelyan were among those who actively pushed on State activity; yet they repeatedly avowed their faith in individualism. Frere held that the proper duty of a Government was merely "to protect men in the enjoyment of their rights and possessions, as long as they do not interfere with the rights and possessions of others, and to remove all obstacles, natural or artificial, to such enjoyment." Yet, in all the positions that Frere occupied, he was an active interventionist. He wanted the Government to undertake irrigation works and to engage in a thousand things which in the West were then and long afterwards looked upon as entirely outside the sphere of the State. It was the grim realities of life in India that changed these men into convinced interventionists. The frequent droughts and famines, the depopulation of whole regions by the failure of crops and the visitations of plague and malaria—these were the facts which made *laissez faire* look hideous in the Indian environment. When Frere was carrying out irrigation works in Bombay, one of his children asked him why he was perpetually talking of irrigation, and he replied : " If you had seen men's bones, as I have, lying unburied by the roadside and on entering a village had found it untenanted by a living person, you would know the reason why."[3]

This change of attitude may be seen in the Government's agricultural policy. In the Provinces, notably in Madras and the Central Provinces, agricultural experiments were started on a systematic basis, and the Government of India encouraged them. It was the recurrence of drought and famine that goaded the Government on to a forward policy. The severe famine of 1860 served as an eye-opener in this respect. In order to be forewarned of the outbreak of famine, it was decided to collect statistics of crops and prices, and the Provincial Governments did this from 1866. The statistics thus collected were published in their revenue returns and administration reports. About that time, the Bombay Presidency made a rapid stride forward, thanks to the cotton boom, and appointed a Commissioner of Cotton and Commerce, who was largely concerned with statistics. This post was later abolished, but the Provincial Governments continued to collect statistics of crops and prices.

by a good landlord fall in India in a great measure upon the Government. Speaking generally, the only Indian landlord who can command the requisite knowledge and capital is the State." (Hunter's *Life of Mayo*, Vol. II, p. 322.)

3. Martineau, *Life of Sir Bartle Frere*, Vol. I, p. 415.

Nor was the Government of India idle. The first two Viceroys were concerned largely with the pacification of the country after the Mutiny, but Lord Mayo had the time and the inclination to give careful consideration to the economic requirements of the country. In 1870, a central Secretariat was established for the collection of statistics and for performing various miscellaneous duties connected with the census, trigonometrical survey, geological survey, etc. This new Department was presided over by a Director-General of Statistics and the first holder of this post was Mr. (later Sir) William Wilson Hunter, who was already engaged in preparing the Gazetteer of the Indian Empire. Under his guidance, voluminous statistical surveys of Bengal and Assam were carried out.

A new Department of Agriculture was also created by the Government of India in 1871, as a result of Lord Mayo's far-sighted statesmanship. In connection with this, Lord Mayo wrote to the Secretary of State in 1870 ; "For generations to come, the progress of India in wealth and civilisation must be directly dependent on her progress in agriculture. Agricultural products must long continue the most important part of her exports ; and the future development of Indian commerce will mainly depend upon the improvement in the quantity and quality of existing agricultural staples, or on the introduction of new products, which shall serve as materials for manufacture and for use in the industrial arts. . . . There is perhaps no country in the world in which the State has so immediate and direct an interest in such questions." [4]

The new Department was greatly needed. Manchester was calling for more of India's long-stapled cotton and the cultivation of that crop was increasing all over the Deccan and elsewhere. At the same time, the hill-sides of Assam were being converted into tea plantations; and on both sides of the Western Ghats in the South tea and coffee estates grew in number and extent. Commercial crops were increasing in importance and the need for research and experiment was becoming urgent. Unfortunately, Mayo's successor, Lord Northbrook, did not realise the importance of the new Department. The war with Afghanistan and a famine in the Deccan resulted in a financial stringency, and the new Department was abolished in 1879 as a measure of retrenchment.

The Royal Commission appointed to enquire into the question of famine (1879-80) reported to the Government of India that

4. *Life of the Earl of Mayo,* Vol. II, p. 321.

agricultural improvement was the first requirement of the country, if famines were to be prevented or kept under control. They therefore recommended that the Department of Agriculture in the Government of India should be revived and separate departments of Agriculture created in the provinces. As a result of their recommendations, Departments of Agriculture were created in the Provincial Governments and a central Department was opened in the Government of India to co-ordinate their activities Mr. (later Sir) Edward Buck was appointed in 1881 as the first Secretary.

For a long time the principal work of the officers of these new Departments was the collection of agricultural statistics. Agricultural experiments were difficult to make and specialists were needed to undertake them ; but there were few such specialists at that time even in England. The officers newly appointed were mostly members of the Indian Civil Service trained in the orthodox traditions of the Revenue Department. Further, in the eyes of the Government, the collection of statistics was the most pressing need, as they were essential for the fight against famine. The first and foremost duty of the central Department of Agriculture was therefore "to ascertain more systematically and completely, and to render more generally available, statistics of important agricultural and economic facts, in order that the Government and its officers may be always in possession of an adequate knowledge of the actual condition of the country, its population and its resources."[5] The provincial Directors of Agriculture were able to help in this.

4. *Crop Forecasting*

The agricultural statistics collected and published by the Provincial Governments from 1867 included not only crop statistics, but also prices and trade returns. But there was little uniformity in the statistics of the different provinces; nor was their accuracy of a high order. Further, as the figures were published long after the crops were harvested, the information was not of any great help to traders or to the public. What traders needed was a forecast of crops well in advance of harvest, and no such forecasts were provided, or even contemplated. The United States of America had made great progress in the publication of such statistics, and this helped traders in England considerably in their purchases of American wheat and cotton. They therefore memorialized the Secretary of

5. Report of Moral and Material Progress, 1891-2, p. 274.

State on the need for crop forecasts in India somewhat on the lines adopted by the United States Department of Agriculture. The India Office examined the statistical information in the provincial returns and reports, and discovered that the information available was neither accurate nor uniform, and that the methods employed needed to be radically improved. In a despatch dated 4th May 1882, the Secretary of State suggested that the forms used for collecting statistics might be improved, and that crop forecasts should be prepared and published in India and England before the crops were harvested.

The whole question was reviewed at a Statistical Conference of provincial Directors of Agriculture at Calcutta in December 1883. There was general agreement as to the need for crop forecasts especially in regard to crops of considerable commercial importance; it was also felt that the after-harvest reports could be discontinued when such forecast reports had been made available. The Government of India accepted the recommendation of the conference as to crop forecasts, and issued instructions to the Provincial Governments in 1884 for the preparation of forecast reports. It was also decided that such reports from the provinces should be compiled and published by the Revenue and Agriculture Department of the Government of India. Accordingly that Department began to issue annual agricultural tables. In the first year only wheat was dealt with, but in the following year forecasts were made for cotton, oil-seeds, rice and jute. The Government of India issued detailed instructions in 1886 and in the next few years in regard to the preparation of these forecasts. In 1896 groundnut forecasts were included at the instance of the German Consul at Bombay, and in 1900 forecasts of the sugar-cane crop also began to be made.

5. *Statistical Organisation of the Government.*

Other Departments of the Government of India had also been publishing statistics relating to their respective subjects. The disconnected manner of publication and the overlapping involved, detracted considerably from the value of the statistics published, and it was generally felt that it was essential to co-ordinate the various compilations of statistics. In 1895, therefore a Statistical Bureau was opened under the Government of India, with a Director-General of Statistics at its head. When a Director-General of Commercial Intelligence was appointed in 1905, the Statistical Bureau was merged in his office. Later it was felt that statistics should be separated from commercial intelligence and accordingly a separate Department of Statistics was created in 1914. The incon-

venience of this separation soon became patent, and in 1922, statistics again came under the Director-General of Commercial Intelligence.

In 1924, the Indian Legislative Assembly passed a resolution recommending the appointment of a committee to enquire into the economic condition of the people, and accordingly the Government of India appointed a committee consisting of Sir M. Visvesvarayya, Pandit Hari Kishen Kaul, and Professor Burnett-Hurst, to examine the material then available for framing "an estimate of the economic condition of the various classes of the people of British India; to report on its adequacy; and to make recommendations as to the manner in which it might be supplemented and as to the lines on which a general economic survey should be carried out, with an estimate of the expenditure involved in giving effect to such recommendations."[*] The majority of the Committee reported that a Central Statistical Bureau should be established at the headquarters of the Central Government to take the place of the Statistical Section of the Office of the Director-General of Commercial Intelligence and Statistics, with a Director of Statistics at its head and that each province should have a statistical bureau. They estimated that the central bureau would involve an initial outlay of Rs. 16·55 lakhs and an annual recurring expenditure of Rs. 29·15 lakhs, and the provincial offices an initial outlay of Rs. 15·31 lakhs and an annual recurring expenditure of Rs. 28·40 lakhs. This organisation was to be used for carrying out a thorough enquiry into the economic condition of the country with a view to assessing the total production, the national income and the wealth of the country. No action was taken on these recommendations.

The world economic crisis of 1929-30 served as an eye-opener to the Government of India in many respects. The depression seriously affected the trade and revenues of India, and measures had to be devised for counteracting it. At every stage, the need for accurate statistics was keenly felt. The country clamoured for a regulation of trade in the interests of India by means of tariffs; and trade agreements had to be concluded with Great Britain and Japan. But the Government found that their statistical material was not adequate for drawing conclusions and formulating policies. The Government therefore created a Statistical Research Branch under the Director-General of Commercial Intelligence and Statistics at their headquarters (Delhi or Simla) for carrying out a continuous analysis and interpretation of economic and statistical facts and phenomena for a proper appreciation of the economic

situation of the country. In 1934, the Research Branch commenced the publication of the *Monthly Survey of Business Conditions.*

The Government, however, were still not satisfied with their arrangements for the collection of statistics and commercial intelligence and, with a view to carrying out a reorganisation, they invited two British experts, Dr. A. L. Bowley of London and Mr. D. H. Robertson of Cambridge, to make an enquiry into the matter, and certain Indian economists were associated with them. They were asked to advise the Government on the organisation of a central Statistical Department, on the practicability and scope of a census of production, on the materials available for the measurement of the national income and on the initiation of series of index numbers of prices, wages, production, etc. After working for three months in India (January to March 1934), the experts submitted a report, in which they recommended the appointment of a permanent economic staff of four members including two economists and a statistician. They also recommended that an economic census should be carried out in India every five years and suggested the main lines on which it should be organised. For the computation of agricultural income, a survey of villages selected on the random sampling basis was recommended.

These recommendations were long under consideration. The scheme of an economic census was regarded as too costly and was abandoned for the time being. The idea of an economic general staff was welcomed by many, but even this involved additional expenditure and was eventually abandoned. The Government, however, decided in favour of appointing an Economic Adviser and placing under him the Statistical Research Branch which had hitherto worked under the Director-General of Commercial Intelligence and Statistics. In 1937 the Government appointed Dr. T. E. Gregory, of the London University, as the first Economic Adviser, and he came out to India early in 1938 to take charge of the new office. The Director-General of Commercial Intelligence will continue to be in charge of the collection of crop statistics, with his headquarters at Calcutta; but the Economic Adviser in Delhi will undertake the interpretation of statistics. It is expected that the methods of collecting and interpreting statistics will be materially improved in the near future.

CHAPTER II.

CROP FORECASTS

As the most important of the agricultural statistics of India are collected in connection with crop forecasts, the methods employed therein may be given in some detail.

Number and Date of the Different All-India Crop Forecasts.

As already explained, the object of crop forecasts is to afford an early indication of the size of a crop before it is harvested. Such indications are necessary well in advance of harvest, if the industry and trade of the world are to function properly. Therefore, forecasts are made at different times, and they begin soon after the crop is raised. In India three forecasts are usually made on each crop, but for some the number is larger and for others smaller. The number of forecasts and the time-table for their issue for the different crops are given below.

Crop	*Forecast.*				
	First.	Second.	Third.	Fourth.	Final
Rice	20th Oct.	20th Dec.			20th Feb.
Wheat	25th Jan.	6th Mar.	15th April	20th May	6th Aug.
Sugarcane	20th Aug.	20th Oct.			5th Feb.
Cotton	15th Aug.	15th Oct.	15th Dec.	15th Feb.	15th April (Suppl.)
Jute	7-15th July				21st Sept.
Linseed Rape & Mustard	1st Jan.	15th Mar.			1st June
Sesamum	1st Sep.	20th Oct.	15th Jan.		20th April (Suppl.)
Castor		20th Feb.	(only one)		
Groundnut	20th Aug.	20th Oct.			15th Feb.

According to the *Manual on the Preparation of Crop Forecasts*, published by the Government of India, "the object of the first forecast is to afford intelligence as early as possible regarding the area sown and the germination of

the seed, with information regarding the effect of the weather conditions at the time on the seedlings. The second forecast, which is issued generally about a couple of months later, includes the area of late sowings, and indicates the probable character of the expected harvest with information regarding the condition of the crop (generally expressed in terms of percentages of the normal out-turn per acre). The final report contains final estimates of the total area sown and quantitative estimates of the out-turn harvested or expected to be harvested, with remarks on prices, exports, etc."[1]

Table V in Appendix .. gives the estimated areas of rice, sugarcane, cotton and groundnut in the different forecasts of 1933-34 to 1937-38. There are great differences between the areas in the successive forecasts and there is a progressive increase in the estimated area as we come nearer to the final estimate. This does not mean that the estimates become more accurate with the approach of harvest time. The differences are due to the fact that from time to time tracts which had not been sown at the time of the previous forecasts are included. The first forecast gives only the area of early sowings, without any estimates of the probable area of later sowings and of tracts excluded from the forecasts as they are not important centres for that crop. This applies also to the second forecast, and even in the final forecast no attempt is made to estimate the probable area which is excluded from the forecasts but will be included in the final adjusted figures as given in the 'Estimates of Area and Yield.' These discrepancies are indeed noted in the body of the reports which accompany the tables. It is obvious from the above statement that the forecasts are very defective from the point of view of prediction. The total area under the crop and likely to be sown with it should be estimated, so that any differences in the areas shown in the successive forecasts would be due only to errors of judgment in estimating the areas likely to be sown. Estimates for the tracts now left out should be included in the forecasts, so that the figures for these tracts shall not be brought in suddenly for the first time in the final adjusted figures.

Preparation of Crop Forecasts.

There are three factors to be taken into account in estimating the yield of a crop in any region, namely, the area, the standard or normal out-turn per acre and the condition figure representing the relation of the crop reported to the normal crop. If these three

1. Vide *A Manual on the Preparation of Crop Forecasts in India*, Department of Statistics, India, 1917.

factors are known, the estimated yield is obtained by the following formula :—

$$\text{Yield} = \text{Area} \times \text{standard out-turn} \times \frac{\text{condition figure}}{\text{normal figure}}$$

A brief account of the different methods of estimating each of the above factors in various countries may be given here.[2] The methods used in different countries to determine the acreage planted vary widely. Several countries—England, Scotland, Denmark and Hungary—take an annual census of acreage and compile it in time for use during the current season. In some countries—U.S.A., Canada—the estimates are made of changes in acreage from the previous year on the basis of judgment reports by local officers and farmers. The correctness of these estimates is verified by a periodical (generally decennial) census of crops. In still others the acreage estimates are based upon sample data collected from individual farmers so selected as to be typical of the area from which they are drawn.

For the standard out-turn many countries use the average yield over a series of years, but the U.S.A. adopts the hypothetical yield of a crop which germinates and continues to grow under favourable conditions and remains free from injurious agencies.

There are three well-defined methods used throughout the world to express the condition of a crop during the growing season : (1) the percentage method with 100 representing the normal or average, as used in U.S.A., Canada and England ; (2) the numerical symbol method using figures ranging from 1 to 6 or 6 to 1 to indicate the relative condition, as used in Germany and Denmark ; and (3) the descriptive method, where adjectives ranging from ‘ excellent ’ to ‘ very poor ’ are used instead of numbers, as in Spain and Rumania.

In the following sections we shall describe in detail the methods adopted for estimating each of these factors in India.

1. AREA.

Statistics of the area under the different crops are fairly accurate in those parts of the country where land revenue is settled temporarily (i.e. Bombay, the Punjab, the Central Provinces and most parts of the United Provinces and Madras). But in permanently settled tracts (Bengal, Bihar, Orissa and some parts of

2. Encyclopaedia of Social Sciences, art. *Crop and Livestock Reporting.*

Madras and the United Provinces) such statistics are not necessary for revenue purposes and the area figures are generally unsatisfactory.

(a) *Temporarily Settled Tracts.*

In the temporarily settled tracts the figures of area are fairly accurate, because the village accountants take a detailed census of crops every year and tabulate the results very carefully. These lands are also surveyed and mapped in detail and the survey records are carefully preserved by the village officers. But even in these tracts, the statements on which the forecasts are based are sometimes incomplete because the reports from some villages are not received in time. Inaccuracy due to such lapses can be rectified by effective supervision and control by the higher authorities.[3] With regard to the tracts now excluded from the forecasts for want of reports, it should be possible to make estimates and include them in the forecasts on the basis of (1) the figures of area reported, (2) the figures of area reported on the corresponding date of the previous year, (3) the final corrected area of the previous year, and (4) the state of the season as indicated by the figures for the tracts covered by reports.

(b) *Permanently Settled Tracts.*

In Bengal, Bihar and Orissa and one-third of Madras, which are under permanent settlement, the absence of a detailed survey and of a sufficient establishment of village officers makes it impossible to record accurately the areas under the various crops. In Madras there are village officers in some of the permanently settled tracts, who act as the primary reporting agency. But even in Madras there are some permanently settled estates which are not completely surveyed, and in view of the inadequacy of staff and the lack of proper control over them the statements from these regions

3. For instance, the correctness of the figures of area in the United Provinces is attributed to the fact that the Director of Land Records, who is responsible for the figures, exercises close control and effective authority over the reporting agency. (*Vide* Proceedings of the Board of Agriculture, 1919, p. 96). Mr. V. N. Visvanatha Rao, Statistical Assistant to the Director of Agriculture, Madras, remarked in 1924 that 'the inspection of taluk offices by the Director of Land Records and his assistants and the scrutiny by them of the crop statistical and forecast registers in taluk offices had been of invaluable assistance in keeping them up to the mark, and the abolition of this department naturally resulted in their deterioration.' (*Vide* Proceedings of the Board of Agriculture, 1924, p. 120.)

must be considered far from trustworthy. Conditions are much worse in Bengal, Bihar and Orissa, where the forecasts of area are based mainly on the reports submitted by the village headmen (police officers). No doubt, wherever possible, these figures are checked and corrected with the help of officers of the Revenue and Agricultural Departments and non-official agricultural correspondents. But even so they are often mere guesses, and the absence of a professional survey and permanent land records for these regions makes it impossible to test the veracity of the statements supplied. "These area estimates, once framed, are liable to become stereotyped and repeated year after year without regard to the influence of exceptional seasons or changes in the economic conditions of the tracts".[4] In the words of the Royal Commission on Agriculture in India: "These reports are admittedly often mere guesses and are not infrequently demonstrably absurd guesses."

There has been some improvement in the figures for the areas under jute in Bengal as a result of the substitution of presidents of village panchayats for the village policemen as the primary reporting agency. The Director of Agriculture supplies schedules with the necessary instructions to be filled up by presidents of panchayats. These schedules are checked, and corrected, if necessary, by the Sub-Divisional Officers before they are sent to the provincial office where the forecasts are made. This improvement, however, has not been adequate. In 1934, the Bengal Jute Enquiry Committee considered the area figures still very defective.[5] "The Presidents of Union Boards are supposed to check the actual area of jute on village maps, from which their respective totals are compiled. It is known, however, that the checking process is too great a task for the Union Boards, and that the estimates furnished are usually mere guesses which are always conservative and, in most cases, far from the truth."[6]

For improving the figures of jute acreage there are two methods available. One is to have an annual census of area; this is evidently impracticable. The other is to carry out random village surveys. The Indian Central Jute Committee, recently set up, is trying to improve the area figures by resorting to this latter method, and the Government of Bengal is co-operating with it. The technique

4. *Vide* A Manual on the Preparation of Crop Forecasts, p. 4.
5. Report of the Bengal Jute Committee (1934), p. 11.
6. See also A. R. Sinha's paper in *Sankhya*, Vol. III, Part IV.

of random sampling for this purpose was evolved in the Statistical Laboratory, Calcutta, by Prof. Mahalanobis (see Appendix B1).

The random sampling method can be applied more widely. A stratified random sample of the crop area should be taken. Stratification should be made according to size of farm, soil conditions, homogeneity of the area represented, etc., with proper weighting for the different factors. The size of the sample required to secure an accurate estimate would vary with the crop. For a crop like rice, wheat, cotton or jute, which is grown on nearly all the farms in particular regions, a sample made up of about 2 to 5% of the total acreage under the crop would provide a basis for a fairly accurate estimate for the whole area. But, for minor crops a higher percentage up to 25% may be required to ensure reasonable accuracy. Estimates of this kind should be supplemented by a quinquennial or decennial census of crop area to check the results.

Aeroplane photography has also been recommended by the Board of Agriculture in India as a means of getting correct area figures. This method has proved successful in America, England and several other countries, and in some parts of India also.[7] The Board of Agriculture in India passed a resolution as far back as 1919 pointing out that "the possibility of improving forecasts of area of certain crops, particularly in permanently settled tracts, by aeroplane photography, is such as to justify further investigation".[8] The usefulness of this method is, however, limited to finding the total cultivated area of a region as a whole or the area under a particular crop in places where there are large belts of an identical crop. In a country of small holdings producing a variety of crops, it would not be a suitable method for finding the areas under different crops.

Apart from the measures suggested above for improving the accuracy of the reported figures, it is very essential to give clear instructions to the primary reporting agency on the two following points in order to avoid errors resulting from different methods being adopted in different places.

The chief difficulty in arriving at correct crop areas arises from the practice of sowing mixed crops (e.g. wheat and linseed, cotton and oil-seeds, etc.) in the same field. The question of apportioning the area between the two crops bristles with difficulties. One

7. *Vide* Mr. Jacob's remarks on its use in Lahore—Proceedings of the Board of Agriculture in India, 1919, p. 27.

8. *Vide* Proceedings of the Board, 1919, p. 27, Resolution II.

way of overcoming this difficulty is to take the whole area as being under each crop and, when estimating the total yield, to make allowance for this factor by adopting a lower yield for these areas. The defect of this method is that there will be double counting when compiling the total areas under the different crops. An alternative method now followed in several provinces is 'adopting some arbitrary formula, specially suitable to the particular crops which are mixed together, and by the help of this formula apportioning the area between the two crops.' Naturally it is not possible to prescribe a general formula which would be suitable for the whole of India, because the proportion depends to a very large extent on the peculiar conditions and practices of the different regions. As in the case of standard yields, these formulae can be fixed only by experienced agricultural officers, and it is desirable to make periodical investigations of the reliability of the formulae by actual field trials, and to make the consequential changes. However rough this kind of estimation may be, the error involved is always less than that which results from recording the area of the whole mixed field as the area covered separately by each of the crops grown together.

Another difficulty arises when the crop sown fails completely after the first forecast. If no other crop is sown on that land subsequently in that year, this area should continue to be included in the area under the crop which was sown. But if another crop is sown after the failure of the first crop, the area in question should be subtracted from the area under the first crop, and added to the area of the second crop in the subsequent forecasts and the final figures.

2. THE NORMAL YIELD.

Definition:—In order to estimate the normal yield per acre of any crop in a region, it is necessary first to decide what the term 'normal crop' should be taken to mean. The official definition of a normal crop is as follows: "That crop which past experience has shown to be the most generally recurring crop in a series of years, the typical crop of the area, the crop which the cultivator has a right to expect and with which he should be content, while if he gets more he has reason to rejoice and if less he has reason to complain."[9] The yield per acre of such a normal crop is the normal yield per acre. According to the Manual

9. Government of India, Department of Revenue and Agriculture, circular No. 9-22 dated 23-10-1897.

of Crop Forecasts it is " the average yield on average soil in a year of average character " and " this normal or average yield will not necessarily correspond with the average of a series of years' figures, which is indeed an arithmetical abstraction and may possibly never occur ".[10] This last quotation from the Manual shows clearly that the 'normal yield' is not the arithmetic mean of the figures for the yield of a crop over a series of years, and the official definition indicates that the average to be taken is the 'mode'. It is important to note that this 'normal yield' is fixed for as large an area as a whole district; this presents a difficult problem in averaging the figures for numerous villages. For a single village we can take the mode of the figures over a series of years. But it is not quite clear whether the district figure is intended to be the arithmetic mean (simple or weighted) of the normal yields for the several villages or the mode of these figures.

It is instructive and useful to compare this definition of the normal yield with the official instructions of the Bureau of Statistics, U. S. Department of Agriculture. " A normal condition is not an average condition, but a condition above the average, giving promise of more than an average crop. Furthermore, a normal condition does not indicate a perfect crop, or a crop that is or promises to be the very largest in quantity and the very best in quality that the region reported upon may be considered capable of producing. The normal indicates something less than this and thus comes between the average and the possible maximum . . . . . The normal may be described as a condition of perfect healthfulness, unimpaired by drought, hail, insects, or other injurious agency, and with such growth and development as may reasonably be looked for under these favourable conditions. It does not represent a crop of extraordinary character such as may be produced here and there by the efforts of highly skilled farmers with abundant means, or such as may be grown on a bit of land of extraordinary fertility or even such as may be grown quite extensively once in a dozen years in a season that is extraordinarily favourable to the crop to be raised. . . . Sometimes a favourable season for planting is followed by a favourable growing season, with no blight and no depredations by insects, the result being a normal condition. At other times the normal may be maintained by conditions that are exceptionally favourable in one or more particulars counter-balancing conditions that are unfavourable in other particulars ".[10a]

10. *Vide* Manual on the Preparation of Crop Forecasts, p. 5.
10a. Moore, *Forecasting of the Yield and Price of Cotton*, p. 59.

Evidently such a normal condition is only hypothetical and it leaves a very large margin for the personal factor. A normal condition according to one individual may be below normal according to another, and above normal according to a third. When we consider that the current condition of a crop has to be expressed in terms of the normal condition as basis, we can very easily see how much the estimates made by different persons may vary and how unreliable the raw data may be.

Method of Fixing the Normal Yields

The Department of Agriculture in each province is responsible for fixing the normal yield per acre for the several crops in each district. It has been the practice in all provinces in India to fix the normal yields on the basis of the results of a system of crop-cutting experiments conducted for each crop in different districts in accordance with rules specially framed by the provincial authorities. Under this system, plots of land of average quality are selected by responsible officers of the Agricultural or Revenue Department, and the crops grown on them are cut and weighed in the presence of the officers. The results of the experiments are reported to the provincial Director of Agriculture, who on a careful scrutiny of the reports before him, and after comparing the data with the information available from trade statistics, settlement investigations and the like, fixes the standard yield for each crop in each district. These investigations are used to verify the correctness of the figures already in use and to revise them if necessary. Ordinarily the figures are revised once in five years.

The method of conducting the crop-cutting experiments and the reliance placed on the results have been subjected to criticism in the past. Mr. G. A. D. Stuart, then Officiating Agricultural Adviser to the Government of India, attacked the present method very strongly in a note submitted to the Board of Agriculture in India in 1919. He said: "Every one will admit that our figures of normal yield per acre will not bear a very critical examination. We have been working from the particular to the general—we have expected to obtain from a comparatively few scattered crop-cuttings on small plots an accurate average of the yield per acre of very large areas. I maintain that no feasible increase of crop-cuttings in the future can improve our figures of normal yield per acre to any appreciable extent. To obtain each year a useful 'random sample' of the yield of a province would require an altogether unmanageable number of careful crop-cuttings.[11]

11. *Vide* Proceedings of the Board of Agriculture in India, 1919, p. 94.

The objections to the present system of crop-cutting experiments are three-fold. Firstly, they are too few to form a reliable basis for generalisations. Secondly, the method of selection followed is what is known as "purposive selection". Since this method is adopted, the experiments depend for their success on the ability of the officer to select representative fields. There is so much scope for the personal factor in such a selection that it is very doubtful whether the sample is really representative. Thirdly, it is not possible to compute the probable error of the average yield from such a sample and hence it is not possible to compare different sets of figures and find out whether the differences between them are really significant or not. All these objections can be overcome by selecting a large number of plots in each district on a purely random basis. The Royal Commission on Agriculture summed up the criticism of the existing methods in the following words: "The practice of selecting by the eye 'average' crops for conducting the experiments is condemned by statisticians. The recasting of the standard yield every five years on miscellaneous data such as are used in the Punjab is also considered to be statistically faulty. To strike a balance between the results of crop-cutting experiments annually made and the yields fixed in previous returns or for the purposes of land revenue assessments is held to import into the new standard the personal factor, which is unavoidable in estimating the annual condition of crops but which it is desirable to eliminate in pure statistics." [12]

Alternative Method for Fixing the Normal Yield.

Even as far back as 1919, the existing method of fixing the normal yield chiefly on the basis of crop-cutting experiments was criticised, and Mr. G. A. D. Stuart proposed to replace this by another method. "It is obvious that a correct figure of yield per acre in any one year can be obtained from the formula,

$$\text{Average yield per acre} = \frac{\text{Total crop}}{\text{Total area}}$$

and that the normal yield per acre represents the average of the yield per acre thus obtained over a series of years. We have fairly accurate figures of area....... I would endeavour to ascertain what the actual total yield of a crop had been by the collection and detailed study of statistics of movement by rail or sea, of manufacture or of any process such as baling,

12. *Vide* Report of the Royal Commission on Agriculture, p. 607.

and of estimates of local consumption."[13] The Board considered the proposal and accepted it, though they were aware that the difficulties in the way of ascertaining the actual yield in the way proposed by him were great. They hoped that in a short time the somewhat defective figures which would have to be expected at the outset would be replaced by accurate figures for all the years of the period used for calculating the average. They considered it desirable that the use of the term 'normal' should entirely disappear in this connection and that the results obtained by this method should be called the 'average yield'.[14]

Stuart's proposals were defective. He argued that it was possible to make a fair estimate of the total yield of a crop in any area, by a careful analysis of the statistics of rail-borne trade, of manufacture and of estimates of consumption, following the method adopted by the American Bureau of Statistics. Unfortunately, our methods of production and marketing are fundamentally different from those of America. No doubt, in the case of crops like jute, cotton, indigo, tea, coffee, etc., where the crops are concentrated in particular localities, or go through manufacturing processes at definite places and local consumption forms an insignificant part of the total production, it is easy to estimate the total yield with the help of trade statistics. But in the case of the main cereals and oil-seed crops of India for which local consumption is the most important factor, the estimates made by fixing an average figure for the consumption per head do not take into consideration the effects of the elasticity of demand over years of plenty and scarcity. Moreover the correctness of such estimates can hardly be verified.

This question was again thoroughly discussed by the Board of Agriculture in 1924, and the Board expressed the view that, while every effort should be made to take the fullest advantage of trade statistics, it was not possible to obtain from such statistics the figures for the total production from which to calculate the standard outturn per acre and that the crop-cutting experiments must remain as the basis of the figures for standard outturns. The following resolution was unanimously passed by the Board. "The standard outturns for various crops now in use have resulted from crop-cutting experiments made over a number of years, verified by such information as has been available from trade statistics. Change should only be made as a result of crop-cutting experiments sufficiently numerous to possess a definite statistical value. In

13. *Vide* Proceedings of the Board of Agriculture in India, 1919, p. 94.
14. *Vide* Proceedings of the Board, 1919, p. 30.

choosing fields for crop-cutting experiments no attempt should be made to select average fields, but the selection should be made purely mechanically so as to give a statistically random distribution. Changes in the standard yield should not be made as a result of discrepancies brought to light by trade statistics, as such discrepancies occur in the product 'condition factor × standard yield' and the fault is most likely to lie in the interpretation of the primary condition reports."[15] The Royal Commission on Agriculture also agreed with this view and definitely laid down that no change in the standard yield should be made except on the basis of data derived from crop-cutting experiments made on a random sampling basis. They pointed out however that, before a random selection of villages and fields for crop-cutting experiments could be introduced, provision should be made for far more numerous experiments than were then being carried out.

We have seen that the 'normal yield per acre' cannot be very precisely defined, and that the value lies between the average yield over a number of years and the optimum yield that can be expected. At present, the normal yield per acre of each of the important crops in the different districts is fixed by the Director of Agriculture or the Director of Land Records on the basis of a system of crop-cutting experiments supplemented by the information gathered from trade statistics, settlement investigations, etc. The existing methods are faulty from the point of view of statistical theory. The number of crop-cutting experiments conducted in each district is too few to provide an adequate basis for generalisation, and the method of selection by the eye is opposed to scientific theory. Hence, to get reliable results, it is necessary (i) to increase the number of experiments for each crop, and (ii) to select the fields on a purely random basis. Again, the results of crop-cutting experiments should not be mixed up with miscellaneous data, into which the personal element enters largely. Experts agree almost unanimously that a very large number of crop-cutting experiments done on the random sampling method should remain the basis for fixing the standard yield.

Recently the question of revising the figures of standard yield with reference to the results of a system of crop-cutting experiments conducted on a scientific basis has been taken up by some provinces. The methods followed in the different provinces will be found in Appendix B2, on 'Crop-cutting Experiments'.

15. Proceedings of the Board of Agriculture in India, 1924, Resolution No. IX, p. 49.

3. The Seasonal Factor

Of the three factors in forecasting, the seasonal factor or the condition figure is the most difficult to arrive at, because it is purely subjective. Once or more often during the growth of the crop, and again at the time of harvest, it is necessary for the purpose of forecasts to estimate the condition of the crop, and this is done by comparing the current crop with the normal. In India, the result of estimation is familiarly known as the 'annawari estimate'. The annawari notation of the normal yield is not uniform throughout the different provinces. In Madras, Bombay and Assam 12 annas, in the U.P., the Punjab, the N.W. Frontier Province 16 annas, in the C.P. and Berar 13 annas 4 pies, and in Bihar and Orissa 12 to 14 annas, denote a normal crop.

In all provinces under temporary settlement, this estimate is made for each of the important crops in every village by the village accountant. The revenue inspector furnishes an estimate for the whole firka for each crop based on the figures of the village accountants and his personal experience. The tahsildar, in his turn, gives an annawari estimate for the whole taluk based on the reports of the revenue inspectors and his personal experience. These taluk estimates form the basis for the district estimates, which are made in the district headquarters in some provinces and in the provincial statistical office in the others. In permanently settled areas the taluk annawari estimates are made directly by the subordinate revenue officials.

This method of estimating the seasonal factor, and the reliability of these estimates have been much criticised for a very long time. Village accountants, who are not given any special training for this particular kind of work, are expected to make a mental comparison between the 'normal crop' and the present crop when mature, and express the yield of the present crop as so much of the normal. Even in the case of a single field this kind of estimation is a difficult matter. "But when it is considered that the condition factor of a region depends ultimately on the effect of the weather on various soils, cultivated with varying degrees of skill and enterprise, planted with different kinds of rice, protected by irrigation works of greater or less efficiency or completely unprotected, liable to or immune from crop pests and harvested over a period of nearly 3 months, it becomes apparent that the guessing ability of the officers concerned has to be remarkable".[16] Hence

16. J. A. Hubback, I.C.S., "Sampling for rice yield in Bihar and Orissa" (Agricultural Research Institute, Pusa, Bulletin No. 166), p. 2.

it is that the figures of condition factor are looked upon with some suspicion.

This criticism of the 'condition figure' is not peculiar to India. In spite of its very large expert staff, the American Bureau of Statistics is not particularly successful in arriving at an accurate figure for the condition factor. But by its superior methods of tabulation of the data and a scientific use of all the available information, it is able to get nearer to the truth in forecasting the yield of the crop.

Apart from this general defect, the Indian figures are criticised on account of the bias attributed to them for several reasons. As has been pointed out in the Bowley-Robertson Report, "no process of averaging, however, can remove a general bias, and it is not worth while to apply any refined process unless the bias has been removed and the correctness of the integral anna statement can be accepted." The bias can be classified under two important subheads: (1) that due to the pessimism of the reporting officers, and (2) that due to the relation of the crop yield to the land revenue assessment.

It is generally held that the village officers are pessimistic by nature, and that this leads to the condition of the crop being under-estimated. Dr. (now Sir) D. B. Meek in his memorandum to the Royal Commission on Agriculture in India writes: "The condition estimate is, in the first instance, prepared by the patwari, or village official who, being generally untrained and pessimistic by nature, is hardly able to form a correct estimate of out-turn in terms of the normal crop. His idea of a normal crop is that which he longs to see but rarely sees and the result is that the standard with which he compares a crop is really something above the normal. Consequently his estimates generally fall below the mark."[17] Dr. Meek explained in his oral evidence that this under-estimation was due to the fact that the figure given by the patwari tends to be a percentage of the optimum rather than of the normal crop.[18] Mr. G. A. D. Stuart estimated that, on account of this general pessimism, "the final integration of the estimates of the large number of village accountants always works out at very much below 100%—it is usually nearer 75%."[19]

But, as has been pointed out by the Royal Commission on Agriculture, it is easy to take an exaggerated view of the degree

17. Royal Commission on Agriculture in India, Evidence, Vol. I, Part II, p. 358.

18. *Ibid.*, p. 368.

19. Agricultural Journal of India, Vol. XIV, 1919, p. 277.

of consequent inaccuracy. Even if such a general bias exists, it can be corrected by Stuart's method. Suppose that over a series of years, the reported condition figures are $C_1, C_2, \ldots C_n$. If n is large, in the natural course of events we expect

$$\frac{C_1 + C_2 \ldots C_n}{n} = \overline{C} = C$$

where C (annas) is the normal condition factor, 12 as., or 14 as., or 16 as., as the case may be. But if there is an under-estimation every year $\overline{C}$ will be less than C. In such a case, instead of taking C, fixed as the normal condition figure, we can substitute $\overline{C}$ in its place and calculate the condition factor on the new basis, i.e. the condition factor of the rth year will be $C_r \times \frac{C}{\overline{C}}$. It should be remembered that the correction factor $\frac{C}{\overline{C}}$ should be worked out separately for each crop and for each district, because great variations exist between different crops even in the same district, and for the same crop between different districts. This method of correction is based on the assumption that the proportionate error in the estimates of the patwari at different points of the range is constant, whereas in fact the real ratio may be different. Mr. Stuart himself was aware of this defect. But he pointed out that "to evolve a formula for this correction would imply a detailed study of the variation in yield of crops with season and the correlation of this variation with the village accountants' estimates, a piece of research which has not been taken up".[20] A detailed statistical study of the reported condition factor in different taluks over a large number of years is necessary in order to evolve a correct formula. Meanwhile Stuart's method serves a very useful purpose in correcting the rough data and it can very advantageously be followed, until a better method is evolved.

It is generally held that the figures of the annawari estimate are sometimes vitiated on account of the fact that in temporarily settled tracts remissions of land revenue have to be granted when the seasonal condition falls below a certain percentage of the normal. It is possible that, when the seasonal conditions are on the

20. *Vide* Agricultural Journal of India, Vol. XIV, 1919, p. 279.

border line for the grant of remissions, some over-zealous village accountants and subordinate officers may pitch their annawari estimates too high, thinking that they will displease their superiors by the possible loss of revenue. Hence in the case of such borderline figures it is always desirable that the higher officers should personally check the returns of the primary reporting agency and satisfy themselves that they are correct, before sending them to the provincial office. Efficient supervision and control are essential in order to check any tendency to furnish stereotyped or wrong figures and to make the available statistical data as useful and reliable as possible.

Fixing the Taluk and District Seasonal Condition Figures.

With regard to the calculation of the seasonal factor for a crop for a taluk as a whole from the annawari estimates for the villages, it is necessary to consider what kind of average should be adopted. Dr. Bowley has pointed out that in the Indian procedure the detailed arithmetical methods that would give more accurate results are almost deliberately avoided. The average to be adopted by the district officer or his deputy is not stated. He does not take the arithmetic mean of the estimates of all the villages in the taluk, but either takes the mode or more often fixes a number according to his own judgment and personal impressions. The only justification for this particular method is the unreliable nature of the figures of the primary reporting agency and the greater reliance that can be placed on the opinion of the higher revenue officer. But if the bias of the village accountants were corrected in the manner described above and the yield stated with reasonable confidence to the nearest anna for each village, the weighted arithmetic mean (weightage being proportional either to the acreage under the crop in each village or to the expected yield in each village) of these statements would give the condition factor for the taluk with a high degree of precision. The weighted average of these taluk estimates gives fairly accurate results for the district and the province as a whole. The condition factor for each taluk or district could well be expressed as a percentage of the normal instead of as so many annas.

Madras has given a lead to the other provinces in this matter. The Government of Madras have defined the manner of arriving at the 'firka'[21] and taluk figures in their recent amendments to the

21. A firka constitutes a group of villages under the jurisdiction of a Revenue Inspector.

Government taluk account rules. They have instructed the officials to use the simple arithmetic average for calculating the condition factor for a firka from the village figures, and to use the weighted average for calculating the condition factor for a taluk from the firka figures. This method deserves to be adopted by the other provinces also.

It will be of some interest in this connection to consider the recommendation which Dr. Bowley and Mr. Robertson made for a change in the method of forecasting. They held that, instead of fixing the standard out-turn per acre and estimating the condition factor in the form of a certain proportion of the standard out-turn, the alternative method of estimating in kalams per acre, maunds per bigha, bushels per acre or similar units would be much more satisfactory. If this direct method of estimating were adopted there would no longer be any necessity for depending upon the 'standard yield' figures, and since the figures of area are known to be fairly accurate, greater attention would be concentrated on removing or correcting any bias in this estimate. This question was considered at the meeting of the Board of Agriculture in India as far back as 1919. The whole subject of crop forecasting was then thoroughly discussed by a committee consisting of provincial Directors of Agriculture under the chairmanship of Mr. (now Sir) Frank Noyce. They made the following recommendation regarding the direct method of estimating yield per acre, and their recommendation was adopted by the Board.

"We have considered and rejected the proposals that a quantitative estimate should be substituted for the anna estimate. The Punjab Director of Agriculture gave us some striking figures which show that even an approximately correct estimate could not be obtained by these means. The instances he cited of the great discrepancies between the quantitative estimates made by experienced agricultural officers and the final results show that it is impossible for an expert to frame anything like an accurate estimate, and it is hopeless to expect anything better from the ordinary untrained reporting agency. We consider that the system of giving the reporting agency a definite figure for the normal out-turn of a particular crop and requesting it to frame its estimate with reference to that figure is open to the same objections. In short, we accept Mr. Stuart's view that the patwari or similar reporting agency must be left to follow his traditional practice and that the only method of arriving at the seasonal factor or condition figure is to interpret his estimate in the light of past experience

of them and to translate them into intelligible language before publishing them."[22]

The point was also raised in the Conference of Empire Meteorologists held in London in 1929, and S. M. Jacob, formerly Director of Agriculture in the Punjab, clearly showed the dangers of the direct method.[23] In the mimeographed description of the Crop Reporting Service of the U.S.A. Department of Agriculture by Mr. W. F. Callander (Chairman, Crop Reporting Board), the whole question is thoroughly discussed, and it is justly pointed out that "it is easier to estimate the ratio of present condition to normal condition than to estimate the number of bushels indicated by the present condition or the normal condition, just as it is easier to estimate the percentage of a full jar to a partially filled jar of beans than to estimate the number of beans in the jar".[24]

Objective Methods of Crop Forecasts.

The official methods of crop forecasting practised throughout the world are subjective, being based on the opinion or judgment of the crop reporters after inspection of the crop. They are therefore naturally subject to limitations and weaknesses inherent in a subjective method and are often the butt of criticism. The following remark about the American forecasts by Mr. Callander is instructive: "The accuracy of certain reports, especially those relating to cotton, has been frequently questioned and several congressional investigations have been made. Technicians have frequently attacked the condition reports, particularly those made early in the season, maintaining that they are merely averages of guesses having little validity and have often criticised the early forecasts as being worse than useless."[25]

Prof. Venn made similar remarks on British methods of crop forecasting. "Everything points to the conclusion that the official statistics of all crop yields in England and Wales display, in varying degree, undue conservatism. If compared with their own initial results they exhibit stagnation. If placed side by side with an alternative series, compounded on similar methods by more numerous local observers, they fall systematically below it . . . They deny

22. *Vide* Proceedings of the Board of Agriculture in India, 1919, p. 30.

23. Agricultural Section II, papers and discussions, p. 289. Vide *Sankhya*, Vol. II, part 3, p. 358.

24. Bureau of Agricultural Economics Bulletin of 1927. Vide *Sankhya*, Vol. II, part 3, p. 358.

25. *Vide* Encyclopaedia of Social Sciences, Vol. IV, p. 610.

adequate expression to the occasional appearance of really good seasons. They refuse recognition to the plant breeder."[26]

To overcome these weaknesses, there have been systematic attempts to replace these subjective methods by more objective methods. These latter attempt to connect crop yields with the effects of weather on crops during the growing period. In this connection scientific workers have followed two main lines of research. During early years investigators tried to find out the cycles in meteorological phenomena as they expected the reproduction of agricultural conditions with repetition of the weather conditions. The work in this direction was disappointing, and, according to Hooker, "the chief difficulty in applying the undoubtedly significant results that had been attained, to anticipate the probable course of events in the future, seems to lie in the bewildering number of cycles actually or apparently determined."[27] Later research work was directed to ascertain the effects of different types of weather during or shortly before the growing period of the crop, on the final yield. H. L. Moore claimed in 1917 that he could forecast the United States cotton crop more accurately from the weather than was being done by official estimates. Important researches in this line have been carried out by R. A. Fisher in England, Wallen in Sweden and Walter in Mauritius. Indian statisticians have also some work in this subject to their credit.[28]

The above methods require the careful application of correlation and multiple regression to the data of a series of years, and the resulting equations can be used for forecasting the future yields. Since 1927 the crop reporting board of the U.S.A. has been attempting to forecast the final yield of some crops by considering weather and other factors in addition to condition reports. It is reported that this has resulted in more accurate forecasts, especially for cotton and potatoes.

26. Vide "British Method of Crop Estimating", by J. A. Venn in the *Economic Journal*, 1926, p. 414.

27. Supplement to the Journal of the Royal Statistical Society, Vol. V, p. 5. "Crop Estimation and Its Relation to Agricultural Meteorology" by J. O. Irwin.

28. S. M. Jacob, "On the Correlations of Areas of Matured Crops and the Rainfall," *Mem. Asiatic Soc., Bengal*, Vol. II ; M. V. Unaker, "Correlation between Weather and Crops," *Mem. Ind. Met. Dept.*, Vol. 24, Pt. 4 ; N. K. Adyanthayya, "A Statistical Study of Paddy yield in South Canara in relation to Weather," *Madras Agriculturist Journal*, Vol. XIX, No. 10 ; S. Ramakrishnan, "Correlation of Weather conditions and Yield of Cotton in Northerns, Westerns and Kumpta cotton," *Sankhya*, Vol. II, Part 1 and Vol. III, Part 1. See also *Sankhya*, Vol. III, Part 3, page 290.

It should, however, be remembered that the relation between crop yield and weather during the different stages of its growth is very complex, and accurate observations of many phases of the crop and its environment other than final yields are necessary if the correct relationship is to be ascertained. In estimating the final yield we must also take into account several other important sources of variation of crop yield such as soil fertility, manuring, cultivation methods, previous cropping and previous growth of the crop itself. Hence forecasts based wholly or partially on observations of the growing crop, which itself serves as an integration of past weather effects, are likely to yield better results than those based on meteorological conditions only. Of the different observations and measurements that can be made on a growing crop, we have to choose the most suitable ones from general considerations, and their value in improving the precision of the forecasts. This requires the study of a series of such measurements for the different crops over a series of years in a number of different places. This work is still in an experimental stage and Dr. Irwin pointed out, in his paper before the Royal Statistical Society referred to above, that the full benefits of the work on the subject may not be received for forecasting the crop yields for 40 or 50 years.[29] An account of the results of the work done on the wheat yields under the crop weather scheme of the Agricultural Meteorological Committee of United Kingdom is given by Dr. F. Yates in the *Journal of the Ministry of Agriculture of the United Kingdom*[30] and by Mr. W. G. Cochran in the Supplement to the Journal of the Royal Statistical Society referred to above. The different factors that were selected for observation and measurement were (1) counts of plant, shoot and ear numbers and (2) their height measurements, at intervals of from one to three weeks from sowing to harvest. Special observations are made for appearance above ground and the time of emergence. The observations were carried out in eight stations in the United Kingdom. As it would obviously be impossible to measure and count all the shoots on even a small area, a sampling technique was evolved by which observations are made on a set of random samples of crop freshly chosen at each time of observation. From an examination of the results of some years, three factors were found to be highly correlated with the yield of wheat, viz. (1) shoot height at ear emergence, (2) plant number in early spring, and (3) ear number. Before applying the results of the

29. *Ibid.*, p. 11.
30. Vide Vol. XLIII, p. 156-62.

experimental fields to forecast the yields on a commercial scale allowance must be made for the loss in weight of the grain after dressing and also losses due to carting, threshing or in the stack. Allowances must also be made for the effects on yield near hedges, the shading of trees, etc.

4. Final Statistics.

So far the method of making crop forecasts during the growing season up to the harvest has been discussed. At present figures of yield made up of the final forecasts together with the necessary additions for regions excluded from the forecasts are published in the volume 'Estimates of Area and Yield', as 'actual yields'. It is a misnomer to call them actual yields, because it is practically impossible to know the actual yields for reasons given below. "In fact harvest results cannot be known with great precision in any country, however good its organisation for the purpose." [31] Farmers do not maintain any regular accounts of the production of their crops, some of which are harvested periodically over a series of weeks. A part of the grain crops is often used on the farm itself for human and cattle consumption, for which no accurate information is likely to be available. At best, we can obtain information regarding the amount of crop sold on the farm, and the other figures can only be estimated. Therefore we may call the figures published after the harvest "Final Estimates".

As the figures of final forecasts are subjective estimates, no great reliance can be put on them, unless their accuracy is checked by an independent method. It is comparatively easy to obtain independent estimates of the total yield in the case of crops like cotton, jute, tea, coffee and rubber, the bulk of which are intended for trade purposes, and go through some manufacturing process on a large scale at important centres. Thus a tolerably good estimate of the actual yield of cotton or jute in any particular year can be made from the figures for exports, mill consumption, extra-factory consumption, and the stock at the beginning and the end of the year. This is rendered possible on account of the fact that direct local consumption is comparatively small, and detailed statistics can be obtained for the other factors from traders and mill owners who handle the crop in

31. Vide A. L. Bowley and D. H. Robertson: A Scheme for an Economic Census of India, 1934, p. 37.

bulk. Similarly for the plantation crops like tea, coffee and rubber, all of which pass through the manufacturing process at definite places, correct information can be obtained by sending schedules to the planters concerned to be filled up and returned. If secrecy is guaranteed in respect of the individual figures, their co-operation can easily be obtained. In fact, the respective trade associations concerned with these plantation crops make their own estimates by these methods. At present these returns are only voluntary, and the statistics are inaccurate because a few planters always fail to send the required information. If errors persist, legislation should be undertaken making it compulsory to return schedules accurately filled up. But in the case of main cereals and oil-seeds, the bulk of which is locally consumed, it is not possible to make any such independent estimates, because these commodities are produced primarily for consumption in the country and are not generally sent to big mills for cleaning and other purposes. A rough estimate of the average annual consumption per head of each of these crops can be made for any region. On the basis of these estimates together with the foreign and internal trade figures, the yields in any year can be estimated. But the defect of this method is that it does not take into consideration the effects of the various economic factors of demand, supply, price, etc. on the consumption of a commodity in any particular year.

Unfortunately, even in the case of crops for which independent estimates can be made, the discrepancies between the figures of the "post-mortem examination" and the revised estimates made now exceed reasonable limits. It was pointed out by Mr. (now Sir) H. A. F. Lindsay in 1934 that "taking the last ten years for which statistics are available the trade record of the actual cotton crop which came into sight each season exceeded the official estimate by 838,000 bales on a total average annual crop, for the ten years, of 5,380,000 bales. In the case of jute the trade estimate exceeded the official estimate by 119,000 bales each season on an annual average crop during the ten years of 8,633,000 bales".[32] That the jute crop has been under-estimated even in recent years is clearly brought out in an article in "Capital".[33]

32. *Journal of the Royal Statistical Society*, 1934, p. 405.
33. See *Capital*, July 22, 1937, p. 97.

,000 bales of 405 lbs. each.

	1932-33	33-34	34-35	35-36	36-37
Crop forecast ..	5,844	7,933	7,964	6,396	8,736
Trade figure ..	8,663	8,944	9,791	8,149	10,697
Difference ..	—2,819	—1,011	—1,827	—1,753	—1,961

These differences are serious and show the necessity for completely overhauling the existing methods of forecasting crops.

In order to improve these statistics, concentrated work must be done in two directions, namely, retrospective and prospective. All the available information as to the distribution of the crop after it has been harvested should be collected with a view to finding out the actual yield in any year. This work, familiarly known as the post-mortem examination, should be done for a number of compact regions in different parts of the country. The figures of actual yields thus obtained should then be compared with the forecast figures for these regions. This method should expose the weak links in the chain of forecasts, namely the particular regions which were mostly responsible for their inaccuracies. Efforts should then be made to find out the causes of the errors, and to eliminate them so that future forecasts will be accurate.

The Indian Central Cotton Committee, Bombay, has been doing invaluable work in these two directions during the past few years. In view of the criticisms levelled against the provincial and All-India cotton forecasts, a cotton forecast improvement sub-committee was appointed, to meet as soon as possible after the publication of the final cotton forecast and to prepare a report on the degree of accuracy of the forecasts with recommendations for their improvement in future. This sub-committee undertook an examination of the cotton forecasts from the 1932-33 season onwards. Comparative figures of actual yields, on the basis of trade figures, and of forecast figures are given in Appendix A, Table VI. By analysing the figures for different years, the sub-committee was able to show that there were considerable discrepancies in the yield figures for certain regions, due to the adoption of low figures of standard yield. They also held that it was necessary to revise the estimates of extra-factory consumption and this was later done on the results of village surveys conducted for the purpose.

The serious under-estimation of the jute crop every year and the efforts being made by the Central Jute Committee to improve them have already been mentioned. Similarly, the tea, coffee and rubber Associations might take up the work of the post-mortem examination of the respective crops. This work is made easier on account of the international agreements made a few years ago to restrict the production of tea and rubber. Under this scheme a planter is bound to submit returns of area and yield, and, if the inspection were made more rigorous and the rules more

stringent, the actual figures could easily be obtained with a considerable degree of accuracy.

As has already been pointed above, these methods will not be of much use in estimating the actual yields of such crops as the main cereals and oil-seeds. For these crops the most convenient method of estimating the total crop with reasonable accuracy is the application of 'random sampling' technique.

In the first instance, a fixed panel of three or four farms in each of about two hundred villages in each district should be chosen by a random method. On each farm two fields should be chosen afresh each year by a random process. The method of estimating the average yield of these fields may be on the same lines as in crop-cutting experiments. The estimate of the mean yield of a district will be available immediately after the last of the sampled farm is harvested. It was shown by Mr. Cochran in the paper quoted above that an estimate of the mean yield of wheat in England could be obtained with a standard error of 1 per cent, by sampling five hundred fields. Though the sampling process may appear to be very simple, in actual practice many difficulties will arise. The primary difficulty is to obtain a stratified random sample of farms, containing different varieties of soil, crop and cultivation methods. In addition, we have to meet certain administrative difficulties. The owners of these farms must co-operate with the experimenters in carrying out the observations. The same set of farms must be used for conducting the experiments on the same crop over a series of years. Finally the Government should provide the necessary staff for carrying on the investigations.

The information obtained from the post-mortem examination of the yield of a crop will not be available for at least a year after the harvest. Hence in all publications giving the yield of crops, the preliminary figures should be given as 'Final Estimates' and, after the 'post-mortem' figures are available, they should be given in the subsequent publications under the heading 'Revised Yields.'

Publication of Forecasts

On the due date, the provincial forecast figures for each crop (except jute) are sent to the central office of the Department of Commercial Intelligence and Statistics in Calcutta and also published in the Provincial Governments' Official Gazettes. The central office scrutinises all the reports and compiles the general Memorandum for all-India, which is published in leaflet form and also reproduced in the *Indian Trade Journal.* As regards jute, the

All-India Memorandum is prepared by the Director of Agriculture, Bengal. Good publicity is given now-a-days to these forecasts through the local daily newspapers and the commercial papers.

A revised system of preparation and issue of All-India crop forecasts is being followed by the Department of Commercial Intelligence and Statistics for sometime past. The main features of the revised scheme are as follows:—

(*i*) Compilation and publication of All-India forecast figures, in the first instance of crops in which the trade is primarily interested. The detailed forecasts with information relating to weather and crop conditions in the different provinces and in foreign countries, etc., are prepared and published subsequently, generally after a week.

(*ii*) Confidential treatment and release of provincial and All-India forecasts simultaneously. Exact date and hour of release of All-India figures for each forecast are announced in the press in advance and communicated to local authorities to enable them to issue their local forecasts simultaneously, and

(*iii*) Dissemination of forecast information throughout all parts of the country with the help of new agencies and All-India radio. The All-India figures, as soon as released, are handed over to Associated Press, United Press, etc., and telegraphed to selected centres so that the information may be available everywhere at the same time. The figures are also telegraphed to broadcasting stations at the same time for being broadcasted as soon as received.

The system was first adopted in the case of cotton forecasts only. But it has been extended to wheat forecasts from the year 1938. In the case of other All-India forecasts, points (i) and (iii) are also being followed, together with the announcement of the exact dates of their issues in the press in advance.

The time-table for these forecasts shows that the information made available to the public about a crop is at least a month old in India, whereas in the United States and other countries the forecasts include information only a week old. Naturally this delay reduces the utility of the forecasts, because much may have happened to the crop between the date of the original reports and the date of publication. This delay is mainly the result of two factors. Since India is such a large country, it naturally takes a long time for the reports of the primary reporting agency to pass through various channels in the province and reach the central

office at Calcutta. The difficulty is aggravated by the fact that the crop reporting work is only a secondary duty of the officials of the Revenue Department, whose main pre-occupation is their Revenue work. On account of their heavy and urgent Revenue duties, crop reporting often gets delayed. In framing the time-table for the various crop-forecasts, allowance has been made for these factors and unless these difficulties are overcome, it will not be possible to publish more up-to-date crop forecasts. As regards publicity, any literate man interested in these matters has easy access to this information through the daily Press and the *Indian Trade Journal*. But the information published in the Press may easily go unnoticed and the *Indian Trade Journal* does not reach the villages. Hence it is desirable that small pamphlets containing this information should be distributed, either free or at nominal prices, through post offices, village co-operative societies and panchayats. The radio also may be used with advantage in this matter. If the importance of these forecasts is impressed on the public and the information made readily available to them, the ryots should benefit considerably.

An important pitfall concealed in the present method of compiling the All-India forecasts is the maintenance of a rigid time-table irrespective of the seasonal variations between the different provinces. The seasons of tropical Southern India are not the same as those of sub-tropical Northern India. But in fixing dates for the All-India forecasts, to be announced for the whole country, these local variations have been largely ignored. This causes certain discrepancies between the final forecasts and the final adjusted figures as published in 'Estimates of Area and Yield'. For example, at the time when the final All-India forecast for rice is published, the large second crop of rice in Madras would not have been sown completely and could not be accounted for fully in the forecast. On the other hand, this Madras second crop will be included in 'Estimates of Area and Yield', which takes into account all crops harvested before the 30th June and the standing crops sown within three months before the 30th June. Similarly, the sesamum forecasts cannot include the large area under this crop in Madras and Hyderabad. In order to avoid these difficulties, one of the following methods may be adopted :—

1. Estimates may be made for these late varieties on the basis of previous experience where it is not already done.

2. Each province should be allowed to work out its own crop forecasts with due regard to the local crop seasons, and the All-India crop reports published every month throughout the crop

season should summarise and tabulate the provincial forecasts received up-to-date; and at the end of the crop season of the late varieties, a final memorandum including these should be issued during the crop year as is now done.

Utility of Crop Forecasts.

Before closing this chapter, a word may be said about the practical value of crop forecasts. These forecasts are primarily important to marketing and distributing agencies, because they deal in commodities, and timely information about the extent of supply is of great importance to them. What is usually not realized is that the crop forecast is also equally important to farmers themselves. With its help they can adjust the acreage under different crops to meet market requirements, and can sell their produce in the most advantageous manner. Forecasts are also helpful in stabilizing prices. In the absence of crop forecasts, speculation of a harmful nature may arise, and this will do injury to agriculturists. Forecasts are a help even to bankers, because they will know in advance what funds will be needed for financing the production and marketing of crops, and as for manufacturers accurate information about raw material supplies is essential for planning industrial production. The whole of the present complex mechanism of production and exchange cannot function properly without crop forecasts. Hence the need for improving the accuracy of these forecasts.

CHAPTER III

AGENCY FOR COLLECTING AGRICULTURAL STATISTICS

In the first chapter a brief history of the collection of agricultural statistics has been sketched. In this chapter it is proposed to give a more detailed account of the primary reporting agency and the central offices from which the forecasts are issued in the different provinces.

THE PRIMARY REPORTING AGENCY.

A good central office equipped with a reliable staff of qualified statisticians and computers cannot by itself ensure that statistics are accurate; an efficient primary reporting agency is also essential. In fact the latter is even more important than the former, because all the work done in analysing data and the conclusions based on them will be of no use if the primary data are themselves unreliable. In America and certain European countries, the primary estimates in connection with crop forecasts are made by persons specially qualified for this work, and they receive information from a number of official and non-official correspondents. But in India, the busy officers of the Revenue Department are made responsible for this difficult work, and they have to carry it on in the midst of their rather heavy duties in connection with general administration and revenue collection. They have neither the time nor the special training for the work connected with crop forecasting. This is one of the main reasons for the comparatively unreliable character of Indian crop statistics. Even the Revenue agency is fully available for making the village estimates only in tracts where the ryotwari and temporary settlement prevails and the village accountants keep field records. In the permanently settled tracts the Revenue officers have to rely mainly on the reports of the village headmen, who are only able to make rough guesses which cannot be checked for want of accurate surveys and permanent records. In the following paragraphs we shall give a detailed account of the nature of the agency available for collecting the primary data in two important provinces under each of the above categories. It is based on the appendix to the volume " Estimates of Area and Yield." Appendices C1 and C2 contain an account of the nature of the agency available in the United States of America and England for doing this work.

Ryotwari or Temporarily Settled Tracts:

Madras

Madras is one of the provinces which have the reputation of supplying fairly accurate data. When the reorganisation of the forecasting methods took place after the war (1914-18), Madras had a very efficient Director of Agriculture in G. A. D. Stuart. He made a special study of the subject and improved the then existing methods. The start which he gave to the machinery and the lines of work followed by him have stood the Department in good stead in subsequent years. Madras was also the first province to give effect to the recommendation of the Board of Agriculture in India regarding the appointment of a qualified statistician to help in this work.

About two-thirds of the cultivated area in the Madras Presidency is ryotwari and the rest zamindari or whole inam. All villages in ryotwari areas have been carefully surveyed and mapped and have village accountants called 'karnams', whose work is supervised and controlled by the higher officials of the Revenue Department. For each of these villages the karnam prepares a return showing the areas under the different crops every month and submits it to the revenue inspector, who is in charge of a 'firka' or group of villages. During his periodical visits to the villages, the revenue inspector verifies the statements of the karnams, and he sends to the tahsildar a consolidated statement of the area under the different crops in his firka with his annawari estimate of the yield for each crop when it is due. The latter, in his turn, checks a few of these returns of the revenue inspectors under him, prepares a consolidated statement for the whole region under his jurisdiction known as a taluk, and submits it to the Board of Revenue. The provincial office in charge of the forecasts was for a long time attached to the office of the Director of Agriculture. Subsequently it was shifted to the Board of Revenue, but now it is merged in the statistical section and forms part of the office of the Director of Industries. Formerly under the Board of Revenue there was a provincial officer called the Director of Land Records, who used to tour throughout the Presidency and during his inspection, he checked the forecast registers. With the abolition of that post, the control of the central office over the preparation of the forecasts in the local offices became less satisfactory.

Only some parts of the zamindari areas in Madras have been surveyed, and for those parts returns similar to those described

above are prepared. For the Agency (hill) divisions of Vizagapatam and East Godavary Districts estimates are prepared in the provincial office with reference to the previous year's final figures, the general character of the season, and the estimates for the neighbouring Government areas.

There are 240 taluks in the province, and so for each crop for which forecasts are prepared 240 reports are received in the provincial office. In this office these 240 statements are checked by a comparison with the forecast reports and final audited reports of the previous years, and any obviously inaccurate statement is corrected before the general memorandum for the whole province is drawn up. All the provinces under temporary settlement, except the Central Provinces and the Punjab, follow this method. After the annual 'jamabandi', when the accounts of the village officers are checked by the District Collector or the Revenue Divisional Officer, the final figures are compiled for each taluk and then for the whole province, and they are published in the provincial Season and Crop Reports. But these figures become available only several months after the end of the harvest season.

The Central Provinces

In this province, each tahsil is divided into about four 'divisions', each of which is under the charge of a revenue inspector, who has about twenty patwaris (village accountants) working under him. Estimates of area and outturn are in the first instance made by the patwaris, and they send reports to the revenue inspector. During his tours the latter checks the returns from his personal knowledge and observation and by ascertaining the opinions of the cultivators. He then sends a consolidated report for the division directly to the District Superintendent of Land Records. The tahsildar sends an independent report on the state of crops in his tahsil based on his observations during his tours and this report is generally received in the District Superintendent's office at about the same time as the revenue inspector's report. With reference to these reports, the District Superintendent prepares a consolidated statement for the whole district and sends it to the Deputy Commissioner. The latter consults not only the District Superintendent but also certain non-officials, e.g., leading agriculturists and respectable business firms. Local Boards are also occasionally consulted in regard to important crops. Apart from ascertaining these personal opinions, the Deputy Commissioner also arranges for a certain number of crop-cutting experiments on

representative soils, and finally decides on the district figures on the basis of all the data before him. These district reports are sent to the provincial Director of Land Records, who also consults the Agricultural Department before framing the final estimates for the province. This method of consulting non-officials is in vogue only in the Central Provinces, the United Provinces and the Punjab.

Zamindari or Permanently Settled Tracts :

As Bengal has no establishment of village accountants and subordinate Revenue officials on the lines described for the temporarily settled provinces, the figures are based mainly on rough approximate estimates made by the district officers of the Revenue Department. The police officers, or circle officers where they are appointed permanently, report the figures of area and yield obtained through the agency of village headmen, to the Revenue Sub-Divisional Officers. The latter check them and correct them from their own personal observation during the tours. The district officers' estimates are based on the reports of the sub-divisional officers. There have been frequent complaints that the figures are largely guesses and are almost always underestimates. On account of its special importance, the jute crop has been selected for trying an experiment with a view to improving the forecasts. The Director of Agriculture, Bengal, supplies (through the circle officers and police officers) printed forms to the presidents of village panchayats with simple instructions for filling them up. After being filled up, they are sent back to the Revenue Sub-Divisional Officers who forward them to the Director. The panchayat presidents are persons with local experience, and are intimately associated with and interested in the fortunes of the jute crop. They can therefore prepare better estimates than the village headman, and a marked improvement has been noticed in the figures since the change was made. But still the figures are not as good as they should be. The possible methods of improving them have been discussed in the Chapter on Crop Forecasts.

Lands in Bihar also are permanently settled as in Bengal and the method of collecting the data is the same as in that province. But as survey and settlement operations have been completed in almost all districts, it is possible to check to some extent the figures supplied by the village headmen.

It has already been shown that the work of the primary reporting agency in the permanently settled provinces is defective.

Even the agency employed in the temporarily settled tracts has been much criticised. Most of the village accountants are men of little education and have no training for the work; nor have they any idea of the purpose of such statistics. The accountants, as also the villagers around them, look upon crop statistics as a part of the Revenue work, and therefore are often reluctant to give correct information, even if they could get it. Hence the awkwardness of entrusting the revenue collecting agency with the work of statistical collection also.[1] There is therefore a growing opinion that at least the work of making annavari estimates can be better done by the Agricultural Department. No doubt the higher revenue officers of the district are expected to supervise the work of village accountants, but they have not generally the time for properly checking the figures supplied by the accountants, nor do they always try to counteract the bias above noted. The Famine Commission of 1879-80 urged on the Government the need for training village accountants, and recommended that a special officer should be appointed in every district for supervising their work,[2] but little has been done in this direction so far. As things are, it may be difficult to give the proper training to the accountants. If, as has been proposed, trained rural guides will be appointed, at least in central villages, this new functionary may with advantage be charged with the work of crop-reporting. If this is not possible, it may be desirable to make the Agricultural Department responsible, at least in the work of making annavari estimates (vide infra).

ORGANISATION FOR ANALYSING THE PRIMARY DATA.

Even if the primary reporting agency were completely satisfactory, a suitable staff would still be needed in the district and provincial offices for tabulating and analysing the data scientifically. The taluk estimates are made in the taluk office from the reports received from the several firkas or divisions. In all provinces except Madras and Bombay they are forwarded to the district headquarters, where the district figures are compiled and sent to the provincial Office. But in Madras and Bombay the provincial office is responsible for making the district estimates. The district offices should have enough staff to go through each report carefully, to verify the figures by cross checks and make corrections if neces-

1. Report of the Economic Enquiry Committee (1925), pp. 104-106 (Burnett-Hurst's note).

2. Report of the Famine Commission (1880), p. 41.

sary. After this preliminary work is over the data should be scientifically analysed. The clerical staff of the district offices cannot be expected to be familiar with statistical methods or to understand their importance. They are therefore not fitted for this work, and they do only the minimum amount of routine work expected from them in this connection. Things are not much better even in many of the Provincial Offices. This work is entrusted to the ill-equipped statistical section of the Department of Agriculture or the Board of Revenue, whichever is responsible for the publication of the figures. In spite of the repeated recommendations of the Board of Agriculture in India since 1919 and the pointed recommendation of the Royal Commission on Agriculture, no Provincial Government except Madras has realized the necessity for appointing a qualified statistician to be in charge of this very important work. Hence no improvement in the methods of collecting and analysing the data can be expected, unless by a fortunate accident the officer in charge happens to be especially enthusiastic and interested in these matters. Ordinarily the work is carried on in a routine manner, and shows no improvement from decade to decade.

Owing to the lack of a proper staff and organisation for collecting and for analysing the data, serious errors have been arising in the estimates of yield. The official figures are considered to be so unreliable that big traders in important crops like cotton and jute keep their own agents in prominent centres and rely more upon the information supplied by them. This is in marked contrast with the conditions in countries like America and England, where the Bureau of Agricultural Economics and the Ministry of Agriculture respectively supply very reliable information at frequent intervals. It will therefore be of interest to give a brief description of the methods of crop reporting adopted in those countries. Extracts from the U.S.A. official memorandum on the character and aim of the crop reporting service and the memorandum on the methods employed in the collection of agricultural statistics for England and Wales are given in Appendix C.

It will be found from the summary in Appendix C 1 that each State in the U.S.A. maintains a statistical agent with a group of correspondents under him, and the State agent analyses the data supplied by the several correspondents every month and prepares a memorandum, in the light of the data before him and his personal knowledge of the conditions, and this he forwards to the Federal

Board. This Board has an independent body of county and township correspondents who are selected with special reference to their qualifications. They obtain information from their assistants and, supplementing it with the information obtained from their own observation and knowledge, report directly to the Federal Board. In addition, there is a special field service consisting of travelling agents who are specially qualified by statistical training and practical knowledge. They travel throughout the regions assigned to them and keep in close touch with them, and send their own reports. Finally at the end of the season, a large number of individual farmers and planters, and the mills and elevators, supply very useful information about the total crop raised during the year. Hence the statistician of the Bureau of Crop Statistics, U. S. Department of Agriculture, will have before him four sets of independent estimates covering each State and each crop, supplied by (1) State agents, (2) county and township correspondents, (3) members of the special field service, and (4) non-officials. The results of the analysis of these four estimates are discussed by an expert crop-reporting Board, which fixes the final figures for each State.

As regards England (see Appendix C2), 320 skilled crop reporters are appointed by the Ministry of Agriculture, and each month they furnish on special forms supplied for that purpose a short report on the agricultural conditions and the progress and prospects of the various crops in their jurisdiction, based on their own observation and judgment, and information gathered from the farmers. During the month of June they send printed schedules to all farmers occupying more than one acre of land to be filled up and returned by a fixed date. These forms provide information about the area under each crop. The returns are compulsory under the Agriculcultural Returns Act of 1925. These schedules are collected by the reporters and sent to the central office, where they are tabulated. The estimates of average yield per acre of each crop for each parish are made by the reporters, who base their estimates on information acquired from farmers, threshing-machine owners, and others. The estimated total produce of a crop for each parish is obtained by multiplying the area by this average yield. The parish totals are added together to give the county totals, and these are again added together to give the totals for England and Wales.

Thus we find that the accuracy of the estimates of probable yields in England depends upon the accuracy of the information supplied by individual farmers regarding the area under each

crop, and on the accuracy of the estimates of average yield for each parish made by the crop reporters.

It is clear from the above that the advantage of the American and English methods over the Indian method lies in having (1) persons with special knowledge of the condition of the crops and versed in the art of making estimates as the primary reporting agency,[3] and (2) a highly qualified staff of statisticians to analyse and interpret the data. In addition, the American Bureau obtains a number of independent estimates which can be compared and consolidated when deciding the final figures. Though the system in force in the U.S.A. is the ideal at which we should aim, there are practical difficulties in the way of adopting it in detail. Any proposal for the recruitment of a special staff of suitably qualified persons as the primary reporting agency would be ruled out straightway on the ground of the large expenditure involved. Special efforts should therefore be made to make the best use of the existing machinery and whatever additions are called for should not cost the Government too much.

The estimates of area made by the Revenue Department agency in the temporarily settled tracts are fairly accurate; and hence the existing arrangements for these estimates may well be continued. As for the permanently settled tracts, the suggestions made in the second chapter could usefully be followed. But every effort should be made to improve the estimates of the condition factor. This could be achieved by the following measures:—(1) entrusting the work to qualified people, and (2) obtaining some independent estimates, and fixing the final figures after a comparison of the different estimates. It is generally recognised that the officers of the Agricultural Department are better fitted to make the estimates of the condition factor than the present Revenue agency, since the officers of the Agricultural Department have special knowledge of the crops. In former years, when the staff of the Agricultural Department was small and very few persons with the necessary qualifications were available, it was thought to be undesirable to throw any additional burden on that Department. But now that it has grown and has a large personnel in several provinces and as the number of agricultural graduates available for appointment has also

3. The technical workers of the crop-reporting service in the U.S.A. are selected only after passing civil service examinations of a high standard covering Agriculture, Economics, and Statistics.

greatly increased, it would be possible to entrust this work to that Department and, if necessary, some additional expenditure should be incurred for that purpose. In fact, even now, in several provinces, the Deputy Directors of Agriculture are expected to report on the condition of the crops, though they do not make any quantitative estimates. If this suggestion is to be adopted, crop forecasting should be made an integral part of the agricultural courses in the universities and should form part of a compulsory paper on Economics in the examinations connected with those courses.

The help of non-official agencies should also be enlisted in the work of crop-reporting. It is a well-known fact that leading firms engaged in trade in important crops like cotton and jute have agents for supplying information regarding crop conditions in the chief producing areas, and that these agents keep in close touch with the cultivators. Often their estimates are more accurate than the official estimates. Provided sufficient guarantees of secrecy are given it should not be difficult to obtain information from those firms. In addition, in all provinces there are substantial landholders and public spirited gentlemen, e.g. presidents of co-operative societies and village panchayats, members of local boards and other non-officials, who would gladly co-operate with the Government in this matter and would be able to supply very valuable information. Additional data supplied by non-official reporters would be found very useful as a means of checking the accuracy of the official reports. The information should be obtained on forms printed both in English and in the Indian language most commonly used in each locality. The Royal Commission on Agriculture pointed out that the substitution of the presidents of village panchayats for the village headmen as the primary reporting agency had improved the figures of jute in Bengal, and they strongly recommended that this agency should be utilised for other crops also. At any rate the non-official agency could be used with great advantage for supplementing the official figures.

The improvement of the estimates of the condition factor of the crops can only be a slow process and to achieve success on the lines discussed above will take considerable time. But there is an urgent necessity to strengthen the staff which checks and interprets the data supplied by the primary reporting agency. It is desirable that a graduate in Agriculture who is also qualified in Statistics should be in charge of all the statistical work at the taluk headquarters. If he is allowed to tour for some time in the taluk, his knowledge of the local agricultural conditions would enable him

to check to some extent the accuracy of the reports received by him. If an adequate number of graduates in Agriculture trained in Statistics is not available, Arts or Science graduates qualified in Statistics may be appointed. They should work according to the specific instructions of the provincial statistician in the detailed tabulation of the data supplied by the revenue inspectors and in working out the averages required. The statements prepared by them together with the special remarks, if any, of the higher officials of the Revenue and Agricultural Departments, should be submitted to the provincial office. At each provincial headquarters, there should be a highly qualified statistician as the head of the statistical section. He should have a well-equipped staff of persons with a thorough knowledge of statistical methods and computation work. He should also have some control over the statistical staff in the districts. The data received through the non-official agency should be analysed in the provincial office and for each taluk the two separate estimates (official and non-official) should be compared. If there is any serious discrepancy, efforts should be made to obtain a reliable figure by referring the matter back to the district officers. The final figures prepared by the statistician should be discussed by a body of experts, including economists. This body should decide on the final figures for each crop and for each district, and these figures should be published by the Government.

The cost of putting this scheme into operation may not be heavy, since there would be no need to appoint any special staff, except the provincial statistician in provinces where there is no such officer at present. There should be a permanent cadre, in each district and province, of clerks specially qualified for statistical work and usually engaged in such work. Suitable selected members of the existing staff can be given special training in a short course. Future appointments to this cadre should be restricted to candidates who have had a special training in statistical methods. We make this suggestion to the autonomous Provincial Governments with the hope that their statistical organisation will be soon improved in the interests of both agriculture and commerce. The much desired accuracy of Indian crop forecasts can to a great extent be achieved if the remarkably unanimous recommendations of the expert committees and commissions, which have examined this question from time to time, are given effect to.

CHAPTER IV

GOVERNMENT PUBLICATIONS ON AGRICULTURAL STATISTICS

We will now proceed to give a descriptive account of the most important publications of the Government of India in the field of Agricultural Statistics.

Name of Publication.	*Nature of Information.*
1. *Agricultural Statistics of India,* Vol. I. (annual).	This volume relates to Br. India only and gives information about the following: (1) total area, (2) classification of area, (3) area under irrigation, (4) area under each crop, (5) livestock, ploughs and carts, (6) incidence of Land Revenue, and (7) harvest prices.
2. *Agricultural Statistics of India,* Vol. II. (annual).	This volume relates to the Indian States, and all the tables in Vol. I, except the one regarding harvest prices, are found here.
3. *Estimates of Area and Yield of Principal Crops in India* (annual).	Area, total yield and yield per acre of principal crops during the year of the report and the previous nine years; standard yields of crops for which forecasts are issued; area and yield of certain principal crops in foreign countries; normal and actual rainfall in each meteorological sub-division in India.
4. *Plantation Statistics* (annual). i. Indian Tea Statistics. ii. Indian Coffee Statistics. iii. Indian Rubber Statistics.	These are issued as separate publications, except for a period of about 10 years, 1920-30, when they were issued as supplements to the *Indian Trade Journal.* The following information is contained in them: (1) number and area of plantations, (2) area and production of crops, (3) numbers of persons employed, (4) trade statistics, (5) prices, etc.

5. *Crop Forecasts* (periodical).	Forecasts are published for the principal crops in leaflet form and reproduced in the *Indian Trade Journal* except for a period from 1923 to 1935 when they were published only in the latter. They deal with area, weather conditions and expected yield and also give information regarding crop conditions in foreign countries.
6. *Summary Tables of Agricultural Statistics* (annual).	This includes the main tables contained in Agricultural Statistics, Vol. I, except those relating to livestock, land revenue and harvest prices. It contains advance information published subsequently in Vol. I. It is issued as a separate publication except during the period 1923-30 when it appeared only as a supplement to the *Indian Trade Journal.*
7. *Report on the Census of Livestock, ploughs and carts in India* (Quinquennial).	Number of livestock, etc., in India, as ascertained from the quinquennial census. Comparative figures for foreign countries also are given.
8. *Quinquennial Report on the average yield per acre of principal crops in India.* (quinquennial).	Average yield of principal crops, irrigated and unirrigated in each province and district of British India and in Mysore.
9. *Intermediate Crop Reports.* (periodical).	
10. *Crop Atlas of India.* (occasional).	

We will now deal with these reports seriatim.

1. *Agricultural Statistics of India, Vol. I.*

In this volume, figures are given for each province under seven tables as shown below.

Table I. Total area.

Table II. Classification of area under forests, area not available for cultivation, cultivable waste, current fallows, and net area sown.

Table III. Irrigation, divided into 2 parts : (*a*) total area irrigated from different sources; (b) irrigated crops.

Table IV. Area under each crop, area under double cropping and net area sown.

Table V. Number of livestock, ploughs and carts.

Table VI. Incidence of land revenue assessment on area and population.

Table VII. Harvest prices.

The Appendix gives the standard yield per acre of the principal crops.

In the tables in this volume, as also in Vol. II, figures are given by districts throughout the whole period except for an interval of about ten years from 1920-21, when the district details were omitted in order to keep down the cost of publication of the volumes. On the recommendation of the Royal Commission on Agriculture in India they were revived from 1930-31.

The figures of area in the volumes of earlier years are not strictly comparable with those of later years; because when the publication was first started (1884-5), it was confined to tracts for which accurate returns were available. A considerable part of the country was left out; because in the permanently settled tracts and even in certain temporarily settled tracts, there are no village officials to keep field-to-field records. In 1891, nearly 80 million out of a total of 520 million acres, were left out of account. With a view to filling up this big gap, estimates of area were subsequently made for those parts, which were previously excluded. Thus by 1908-9 statistics came to cover almost the whole of British India and are based on actual measurements supplemented by estimates. These estimates have been improving in accuraey with the progress of survey. Thus the increase in the reported areas was the result of the inclusion of additional tracts, together with the changes in the figures given for certain areas (previously estimated) when they were surveyed.

Another important point to be noted is the fact that up to the year 1919-20 some provinces adopted the financial year (i.e. 1st April to 31st March) as the basic period for their statistics, whereas some others chose the fasli or revenue year (1st July to 30th June). But from 1919-20 all the provinces uniformly use the revenue year except that the Central Provinces and Assam prepare the returns for the year ending 31st May and 31st March respectively, and Bombay prepares the table relating to land revenue for the year ending 31st July.

Table I—Total Area—In this table the area of each province and district according to the professional survey is compared with the total compiled from the figures given in the returns of the villages concerned. From the total area of each province the area lying in Indian States and the area for which no details are available are deducted in order to give the surveyed area for which village figures are available. In former years, the column giving the area for which no details are available included all the permanently settled tracts and those parts of temporarily settled tracts for which no returns were available. But now, since estimates are made for the tracts in question, this column is superfluous. Table I in Appendix gives the area of each province (1) according to the professional survey, and (2) according to the village returns, from 1907-08. The differences between the two sets of figures are clear, but they have been gradually becoming smaller. These differences are found only in the United Provinces, the Central Provinces, Madras, the Punjab, the North-west Frontier Province and Orissa. As regards other provinces, since they are not surveyed, only estimates are given in both the columns and hence they are identical. The differences in the six provinces abovementioned are due largely to the following circumstances:—

1. The village returns do not, in several provinces, cover the whole area included in the professional survey; e.g., in some cases the returns do not include the areas under forests, etc.

2. While the area according to survey is calculated in blocks, the area according to the village returns is the sum of the areas of a very large number of fields, and the sum-total of a large number of errors may sometimes give rise to a considerable total error.

3. There are discrepancies between the two sets of returns as regards the rules for the inclusion or exclusion of areas covered by water, buildings, roads and railways.

Errors 1 and 3 can be rectified by giving proper instructions to the authorities concerned; and error 2 should not be large, unless it is systematic, i.e., unless there is either exaggeration or under-estimation throughout.

Table II—Classification of Area:—The total area of each province or district can be sub-divided under three main heads, area under forests, net area sown, and the balance. This balance is classified in this table under three heads: (1) not available for cultivation, (2) culturable waste other than fallow, and (3) current fallows. The classification of land in the British Indian provinces according to the different heads is given in Appendix Table II.

Area under forests:—In this volume, the area under forests means " any land classed or administered as forest under any legal enactment dealing with forests." Any cultivated area existing within such forests may, however, be excluded from that head and entered in the column ' Net area sown '.

The Administration Report of the Forest Department of each province gives the total area of the forests under its management. We should naturally expect that the area according to this report would tally with that given in the Agricultural Statistics. But a comparison of these figures for some years shows that there are differences which can be explained by the following circumstances:

1. Where the protected forests are transferred from the Forest Department to the Revenue Department or local bodies, municipalities, etc., they are not included in the Forest Department's administration report, whereas they are included under the proper head—area under forests—in the volume on Agricultural Statistics.

2. Where some forest areas are cleared and brought under cultivation, the volume of Agricultural Statistics excludes those areas from the sub-head ' forests ' and includes them under the proper head ' net area sown '; but in the forest administration report such areas are still included.

3. The Administration Report of the Forest Department relates to the financial year, 1st April to 31st March, whereas the volume of Agricultural Statistics relates to the revenue year, 1st July to 30th June of each year.

The great need for a reclassification of the area under forests and for making the forests more useful to agriculturists has been strongly stressed by the Royal Commission on Agriculture in the following words: "Forty or fifty years ago, when there were forest departments, but no agricultural departments, and when the problems arising out of the pressure of population on the soil and the necessity for cattle improvement had not assumed the importance they now possess, it was natural that the forest departments should be regarded as the only departments capable of turning to advantageous use large areas of State land which were lying neglected and which were not required for cultivation. The result was that the presence of trees or scrub jungle was considered sufficient justification for notifying, as forest, land which was, in reality, more suited for grazing or for cultivation than for the growth of trees."[1] They recommended that the time had come to reclassify

1. *Vide* Report of the Royal Commission on Agriculture, p. 269.

the whole area under three sub-heads: (1) land which is suitable for the growth of good timber trees or for fuel plantations (including land, the preservation of which under forests is desirable on climatic or physical grounds), (2) land which is suitable neither for timber, fuel plantations nor for ordinary cultivation, but may possess possibilities for development as fodder reserves and grazing grounds, and (3) land which is suitable for ordinary cultivation. In making this classification, great care should be taken to keep the proper balance between the different parts. This classification will place the provincial authorities in a strong position in regard to making the best possible use of the land at their disposal.

Land not available for cultivation. This head includes all land absolutely barren, hill or rock, and also all land covered by buildings, water, roads or otherwise appropriated to uses other than agriculture. This classification is very crude and does not give us any idea of how much of the land is barren and useless and how much is turned to useful non-agricultural purposes. A better method of classification would be to sub-divide this head into two parts: (1) land barren and uncultivable, and (2) land covered by buildings, water and roads, or otherwise appropriated to uses other than agricultural.

Culturable waste other than fallow:—This head covers land available for cultivation but not taken up or abandoned. It includes also areas such as groves which are not classed in the area sown, and also areas under bamboos and thatching grass when they do not form part of any forest area. The village common lands and other Government waste lands not allotted for cultivation also come under this head. The division of barren land between 'Land not available for cultivation' and 'Culturable waste' is very arbitrary. It is based on estimates in the permanently settled tracts of Bengal, Bihar and Orissa. In regions where some parts are not surveyed, this division is made on the assumption that the proportion between these two parts in the neighbouring surveyed tracts holds good for the unsurveyed parts also (e.g. Assam valley). It is quite certain that much of the land included under culturable waste could not be brought under the plough even at a very high cost. The fact that an unduly large area is shown under the head 'culturable waste' is bound to give a false impression about the scope for the expansion of crop area and so minimise the gravity of the pressure of population on land. It is desirable that both the Government and the public should know more precisely than at present how much of this land is really suitable for cultivation.

Current fallows:—The division of cultivable land between culturable waste and current fallows is very arbitrary in many provinces. This division depends upon the maximum period for which the land has been left uncultivated. This period of time varies according to local customs and laws in the different provinces, from two years in the Punjab and the North-West Frontier province to 10 years in Bombay. After this period the land, if still left uncultivated, is classified as 'culturable waste'. Owing to this diversity of practice in different provinces the classification is not statistically accurate, and no useful comparisons can be made as between different provinces. In the interests of the accuracy of statistics, it is very necessary that a uniform standard should be adopted in all the provinces. .

Net area sown:—If the sum of the areas under (i) forests, (ii) land not available for cultivation, (iii) culturable waste, and (iv) current fallows is deducted from the total area, the balance is the net area sown.

Table III. Irrigation:—This table gives details of the irrigated area according to the different sources of irrigation, viz. (1) Government canals, (2) private canals, (3) tanks, (4) wells, and (5) other sources. The sum of the areas under the above five items gives the total irrigated area. The area under each of the main irrigated crops is also given. They are rice, wheat, barley, jowar, bajra, maize, sugar-cane and cotton. The miscellaneous crops are shown under three sub-heads: (1) other cereals and pulses, (2) other food crops, and (3) other non-food crops. The total area under each crop is the gross area irrigated; areas sown more than once in a year are counted separately for each crop. This explains the excess of the total area under irrigated crops over the total area irrigated, because in the former an area irrigated at both harvests in a single year is counted twice, whereas in the latter it is counted only once. Except for the lands irrigated from Government sources, all the figures are estimates.

Table IV. Area under the different crops:—This table gives the areas under the several crops (irrigated and unirrigated) out of the total area sown. The area under a crop is the gross area, i.e., any area on which two crops were sown in the same year is counted twice for this purpose. At the end, the total area under all crops resown after raising a previous crop in the same year is given and the difference between the total area under the crops and this figure gives the net area sown. The different crops are given under the following

main heads: (1) food-grains, (2) oilseeds, (3) condiments and spices, (4) sugar, (5) fibres, (6) dyes and tanning materials, (7) drugs and narcotics, (8) fodder crops, (9) fruits and vegetables including root crops and (10) miscellaneous crops. Each main head is divided into sub-heads, one for each important crop under the item, and a miscellaneous column gives the total of the minor items. The items included under this last (miscellaneous) column are given at the foot of the table.

There are two important footnotes attached to this table. (1) The table shows the areas actually sown whether the crop comes to maturity or not, except that, when a field owing to the failure of the first sowing, has been resown with a different crop, the area first sown is omitted. When two or more crops are grown together, an estimate is made of the area covered by each and the areas so estimated are separately returned. This estimate is either made by the village accountant or subsequently determined by a formula prescribed by the provincial authorities.

(2) The variations in the areas shown in different years under the same crop in the same tract do not in all cases represent an actual increase or decrease in the area under that crop. In certain cases a revised classification or the correction of a faulty estimate is responsible for the change. In such cases it is desirable to make the necessary changes for previous years, if possible, or else to indicate clearly in a footnote the extent of the correction, the reason for it, and the year when it was made.

In this table the total areas under the different crops are accurate only in the temporarily settled tracts which have been surveyed and have a full establishment of village officers. In other regions including the permanently settled tracts, they are based on estimates. The apportioning of the area between the two crops in areas where double crops are sown is also arbitrary. Some methods of improving these estimates have been discussed in the chapter on crop forecasts.

The figures for this table are compiled from the Season and Crop Reports of the different provinces. The volume entitled "The Estimates of Area and Yield of Principal Crops" gives the areas under some important crops. There are discrepancies between the figures given there and those in 'Agricultural Statistics,' due to the following reasons :—

1. In 'Agricultural Statistics' the area under a crop in any region however unimportant it may be for that particular crop is

included, whereas in 'Estimates of Area and Yield' the figures of area refer to the regions which grow the crop over a considerable extent.

2. 'Agricultural Statistics' contain revised figures based on the actuals, whereas the 'Estimates of Area and Yield' are based on final forecasts.

Table V—Livestock, Ploughs, Carts, etc.—The statistics of livestock will be discussed separately.

Table VI.—Incidence of land revenue assessment on area and population:—This table gives the details of incidence of land revenue assessment per acre of land and per head of population for each province and for the several districts also. These particulars are given for the three important forms of tenure, namely, ryotwari, zamindari and village communities temporarily settled, and zamindari permanently settled. The statistics required for this table are collected annually in Assam, Ajmer-Merwara, the Punjab, Delhi, the N. W. Frontier Province, the Central Provinces and Berar, and quinquennially in Bengal, Bihar and Orissa, the United Provinces, Bombay, Madras and Coorg.

In Ryotwari areas the total land revenue (excluding cesses) under all the heads classed as "Land Revenue" in the civil accounts, represents the actual realizable demand in the year, and no account is taken either of the arrears collected in respect of past years or of amounts left uncollected at the end of the year. In the case of zamindari areas, settled temporarily or permanently, the amounts due by the zamindars to the Government alone are considered as land revenue for the purpose of this table. In order to calculate the incidence per acre, only the net area of land and the total revenue due on this area which is fully assessed and for which the details for this table are available, are considered. The areas which are not fully assessed and those for which details are not available are excluded from the total area in order to get the net area. The difference between the total assessed area and the total cultivated area is equal to the sum of the areas under current fallows and fully assessed waste. The fully assessed cultivated area should be either equal to or less than the net area sown as shown in Table II. For calculating the incidence per head of population, the total population in the fully assessed regions only is considered, omitting for the purpose of this table the population of villages which are either not fully assessed or

for which complete details are not available. The total land revenue of a region divided by the total population gives the incidence of land revenue per head. The land revenue on the fully assessed area divided by the total area and the cultivated area respectively gives the incidence of land revenue per acre of fully assessed area and cultivated. area respectively. Total land revenue on the fully assessed area divided by the total population of the fully assessed area gives the incidence of the land revenue per head in the fully assessed area.

This table does not give a true picture of the incidence of land revenue in zamindari areas, and particularly in permanently settled zamindari areas, because for the purposes of this table only the revenue due from the zamindar to the Government is considered. Even in the temporarily settled zamindari tracts, the amount paid by the ryots to the zamindars is much more than what the latter pays to the Government. Hence the figures given in this table under-estimate the burden of land revenue. But this anomaly is still worse in permanently settled areas like Bengal, Bihar and Orissa, where the assessments were fixed long ago and are far below the rates which the tillers of soil actually pay. Hence these tables do not enable us to compare correctly the burden of the land revenue under the three different systems of tenure, namely zamindari permanantly settled, zamindari temporarily settled and ryotwari.

Even the figures of incidence in the ryotwari temporarily settled tracts are not quite accurate for the following reasons:

(1) In arriving at the area fully assessed, areas held revenue-free or at privileged rates are supposed to be excluded, but no deduction is made on account of such areas unless the entire village comes under one of these categories, and there is some difficulty in estimating the corresponding deduction in population.

(2) The calculated incidence is not the true incidence in any particular year because areas affected by temporary suspensions or remissions of land revenue are included in the fully assessed area, and the total revenue due from them (though not collected) is included under demand. In fact special columns giving the area in respect of which suspension or remission of land revenue is allowed, and the incidence of that revenue would be a useful addition to this table.

(3) The population figures used are those of the previous census. This tends to cause an over-estimation of the incidence in the

intermediate period during two censuses, as the population is steadily growing.

When using this table it must be remembered that the statistics of the incidence of land revenue assessment given here show only the average amount contributed by each acre or per head of population in each province or district towards land revenue. They cannot be used for comparing the burden of land revenue on land in different districts or provinces as no valid comparison is possible without taking into account such factors as the nature of the soil, climate, facilities for irrigation, etc.

Table VII: Harvest prices:—This table gives the harvest prices of certain important crops per imperial maund of 82⁴⁄₇ lbs. The commodities included in this table are winter rice (cleaned), rice (unhusked), wheat, barley, jowar, bajra, maize, gram, raw sugar, cotton, jute, linseed, rape and mustard, sesamum, groundnut and tobacco. The harvest prices of these crops in each district are published in the provincial season and crop reports. The 'median' average, of the district prices of each crop is taken as the provincial price for that particular crop. These averages together with the district prices are published in this table.[2]

The district prices are the average prices at several important stations. To ensure statistical accuracy in these figures great attention should be paid to the exact description of the grade of the commodity for which the price is given at each centre, and care should be taken when making the average that the same grade is used for all the centres. Further, a particular day of the week or month should be assigned for ascertaining the prices in all the stations, for the sake of uniformity. It is also necessary to distinguish carefully between the wholesale prices of small lots and retail prices. As regards the type of average to be chosen, it would be better to use the weighted arithmetic mean with weights in proportion to the production of the crop in each region.

One point to be noted in regard to the tables in this volume is the necessity for reconciling these figures with those found in the publications of other Departments. The necessity for publishing the correct figures in these different volumes has been repeatedly pointed out by the Indian Sugar Committee,

2. From 1936, a new series of harvest prices has been introduced, as an experimental measure. This is published in *The Indian Trade Journal* from time to time. See *Indian Trade Journal*, 6th Aug. 1936, pp. 657-66.

the Royal Commission on Agriculture, and other similar bodies. But on account of different methods of compiling the data, these discrepancies still occur, though of late they have been gradually diminishing. It is necessary to define all the terms used very rigidly, so that there may be uniformity in their use in the different provinces. In a large country like India, agricultural practices differ from province to province and certain technical terms may be used in different senses. For example the distinction between 'current fallows' and 'culturable waste,' and that between 'culturable waste' and 'land not available for cultivation,' vary greatly from province to province. This causes some confusion, and fallacious conclusions may be drawn by people who are unaware of these local differences. Similarly, when giving the harvest prices of the different crops, the exact description of the different grades of the commodities should be carefully stated, and such prices should refer to a particular day of each week.

The failure to give the total yields of the different crops in this volume leaves a serious gap. Of course the standard yields of some important crops are published in the Appendix, but they do not give any idea of the total yields in any year. In the table on the incidence of the land revenue, information regarding the area of the land affected by remissions and the total amount remitted would be a useful addition. If possible, statements might be supplied for computing the incidence of land revenue on irrigated and unirrigated land, and on the areas under important crops like rice, wheat, sugarcane, cotton and jute.

2. *Agricultural Statistics of India, Volume II.*

This volume incorporates figures relating to the Indian States. In the earlier issues of 'Agricultural Statistics,' these figures were given separately in Vol. I, because very few States were furnishing them. Mysore was one of the first States to supply them. Gradually such other States as had the requisite agencies for collecting statistics began to supply figures, and by 1904 the number of reporting States had increased sufficiently to justify a separate volume regarding these States although at first it was rather thin. Efforts were made at various times to increase the number of reporting States. But since the returns are purely voluntary, there is still a considerable area included in the Indian States which is not covered by this publication. The total area of the Indian States dealt with in the volume increased from 189 million acres in 1914-15 to 257 million acres in 1934-35. But

complete statistics of the whole of the reporting States are not available. Even in 1934-35 an area of 111 million acres out of the total area of 257 million acres in the reporting States was not covered by the statistics.

The statistics are also far less accurate and complete than those of British India. The figures of area covered by this publication are less than those published for the Indian States in "Estimates of Area and Yield." This is due to the fact that several States which report the figures for forecasts have not the requisite staff to collect figures in such great detail as are required for this volume.

The same set of tables as is used in Volume I is repeated here except for the fact that the table No. VII in Volume I giving Harvest Prices is omitted from this volume. All the criticisms made in respect of the several tables in Volume I hold good with greater emphasis for those in Volume II.

3. *Estimates of Area and Yield of Pricipal Crops in India.*

The object of this volume is to supply at the earliest possible time, the best estimates of the area and yield of some of the important crops, together with information as to the nature of the seasonal conditions. The main tables in this volume are compiled from the data given in the final forecasts, of crops for which forecasts are issued. In the supplementary table, estimates of area and yield of other important crops, viz., barley, jowar, bajra, maize, gram, tobacco and indigo are given, and they are based upon the provincial season and crop reports or reports especially obtained from the local authorities concerned. At the end is a very useful set of tables giving figures of area and yield of certain crops (rice, wheat, barley, maize, sugarcane, cotton, linseed, rapeseed, tea and coffee) in foreign countries. These figures are obtained from the International Year Book of Agricultural Statistics published by the International Institute of Agriculture, Rome. Finally the figures of normal and actual rainfall, in each province and meteorological sub-division of India, are given in a separate table. All this information is published annually in a convenient and connected form, about six to nine months after the crops of the previous year have been harvested. In this volume the figures are given both for the Provinces of British India and for the Indian States.. In former years both were mixed together, but on the recommendation of the Royal Commission on Agriculture, they are now given separately and the different Provinces and States are arranged in alphabetical order.

Table I—Abstract Table—Area and yield of each crop:—This table gives the area and yield in respect of each of the main crops, namely rice, wheat, sugarcane, tea, cotton, jute, linseed, rape and mustard, sesamum, castor seed, groundnut, coffee and rubber. Quinquennial averages only are given for earlier years, but for the latest five or six years the figures of each year are given separately. For some crops for which figures were not available in earlier years the columns are left blank. In this table the figures of earlier years are not strictly comparable with those of later years, because the estimates for these crops in the forecasts for earlier years did not relate to all the producing areas in India, but only to those tracts where the respective crops were grown on an extensive and commercial scale. But the tracts of minor importance have been added gradually, so that at present for most of the crops the estimates relate to all the tracts in India where these crops are grown to any extent.

Table II—Yield per acre:—In this table the average yield per acre of each of the above thirteen crops in each of the British Provinces and Indian States is given separately in alphabetical order. These details are given for ten years ending with the year of report. These average yields are different from the 'normal or standard yields' given in the next table. The averages are arrived at by dividing the estimated yield of each year in each region by the estimated area.

It is important to note that the statistics of yield per acre given in this table refer to yield per acre sown and not to yield per acre harvested. This implies that if out of a total area of 10 acres originally sown with a crop there is a complete failure of the crop on 5 acres and a yield of, say 30 maunds, is obtained from the remaining 5 acres, the total area and yield of the crop would be recorded as 10 acres and 30 maunds respectively. The figures would therefore give a yield per acre of 3 maunds instead of 6 maunds per acre harvested. Failure to note this distinction often leads to an incorrect comparison of yields per acre of Indian crops with those in foreign countries where the yields per acre generally relate to harvested area.

Table III—Standard or normal yield per acre:—This table gives the standard or normal yield per acre of those crops for which forecasts are prepared, viz., rice (cleaned), wheat, sugarcane (gur), cotton (ginned), jute, linseed, rape and mustard, sesamum, and groundnuts (in shell). The figures are obtained from the quinquennial report on the average yield per acre of princi-

pal crops in India, and the methods of fixing the figures was dealt with in the corresponding section of the chapter on Forecasts.

Tables IV to XVI.—Area and yield of principal crops :—There is one table for each of the thirteen main crops enumerated above. Each table gives the area and yield of the particular crop in each of the different Provinces and States for each year, during the ten years ending with the year of report. The figures of the year of report for all the crops except coffee, tea, and rubber are obtained from the final forecast reports. The figures for the earlier years are revised estimates. The figures of area and yield of tea, coffee and rubber are taken from the annual special statistics separately published by the Department. There is an additional table for cotton giving the total area and yield in the whole of India classified according to varieties or trade descriptions, such as Broach, Cambodias, etc.

Table XVII.—This is a supplementary table giving the area and yield of barley, jowar, bajra, maize, gram, tobacco and indigo in each Province and State. The details are given for all British Provinces and for the few States which supply the data.

Table XVIII.—This gives the normal and actual rainfall (in inches) in each province and meteorological sub-division in India, for each year during the ten years ending with the year of report.

Table XIX.—This gives a comparative statement showing the reported area and yield of certain principal crops (rice, wheat, barley, maize, sugarcane, cotton, linseed, rapeseed, tea and coffee) during each of the previous ten years in important countries of the world.

This volume contains two useful appendices explaining (1) the method of framing estimates of crops and (2) the methods of collecting the statistics in the different Provinces and States.

It has already been pointed out that there are reasons why a comparison of the figures of earlier years with those of later years would not give the increase in the total area and yield accurately. Further, owing to the differences in the methods of preparing the figures in this volume and those in 'Agricultural Statistics,' the areas under the same crop as reported in the two publications for the same year do not always agree. Great efforts are being made to reconcile the two sets of figures by examining the causes of discrepancies and trying to rectify them. Formerly the figures of the Provinces and the States were mixed up together.

But in accordance with a recommendation of the Royal Commission on Agriculture (*vide* Report, p. 602), the details for the Provinces and the States are now given separately, followed by a grand total for the whole of India. This division facilitates comparison of the figures of different years for British India only, which are more accurate than the figures of the States. Moreover most of the area of the Provinces has been covered by reports for a long time, whereas additional regions in the States are gradually being included.

This volume fills a gap in the volume, 'Agricultural Statistics' in that it supplies figures for the estimated yields of the important crops. But there are certain other crops—grains, pulses, fruits, roots and vegetables—which form important items of food or which constitute valuable raw material for internal manufacture or export, and on these no information is available. This is a very serious handicap in attempting to estimate the total agricultural income of the country (see Chap. V). Earnest efforts should be made to include all important crops in this publication. A serious defect in the existing figures is that no efforts have been made to verify the correctness of these estimates except those for cotton and jute. Even for these two crops, the figures of the forecast and the post-mortem examination are given separately without indicating which are likely to be more accurate. This point has already been dealt with in Chapter II. It is essential to obtain reliable figures of actual yields for all the important crops. Of course it will take at least a year or more after harvest for these figures to be available. Hence it would be best to publish provisional figures from the final forecasts in the current issue of this publication and revised figures should be substituted in the subsequent issues.

4. *Plantation Statistics* :

(i) Tea, (ii) Coffee, (iii) Rubber.

Special reports, one for each of the above plantation crops, are published annually by the Government of India. Except for a period of about 10 years from 1921, they have been published as special volumes, and during that period they were published as special supplements to the *Indian Trade Journal*.

Tea Statistics. The 'Report on the Production of Tea in India' is an annual publication and refers to each calendar year. It consists of two parts, the first of which is the main report giving a general account of the several factors regarding the production,

trade, prices, etc. of the commodity, and the second consists of 17 statistical tables. The data for these tables are obtained from the owners of the estates, to whom printed schedules are supplied by the district revenue officers. But since the returns are only voluntary, there are always a few people who do not supply the necessary information. In such cases the district officers make their own estimates for the areas not covered by voluntary reports and send the consolidated report to the central office at Calcutta. Before accepting the estimates made by district officers for areas not covered by voluntary reports, the central office tries, and sometimes with success, to get information from the concerned planters directly. The Indian Tea Association collect figures of area and yield independently of the Government. They have stated before the Royal Commission on Agriculture that their figures are more accurate than the Government's. It is very desirable that these two sets of figures should be compared and the mistakes eliminated, before the actual figures are published.

Tables I and II in Part II are abstract statements of area and yield of tea respectively for each Province and State. Table III gives details by districts for these two items (area and production) according to the number of plantations, and also the details of the daily average number of persons employed in the plantations. Tables IV to IX deal with the foreign trade (sea-borne and land-borne) in tea. Details are given regarding the quantity of tea exported to the United Kingdom and other countries, as also the share of each port in the total exports. One table gives the very useful information regarding the total exports and also the index numbers for exports of tea from the main tea-growing countries of the world, namely India, Ceylon, China and Java. For the first three countries, 1896-97 is taken as base year, whereas for Java 1905-06 is the base. One of these tables gives the imports, re-exports and balance of foreign tea available for consumption in India. Table X gives the total amount of indigenous and foreign tea available for consumption in the country. Tables XI to XIV give information regarding the number of packages of tea sold and also the selling prices of tea in Calcutta and London. Table XV gives the rates of freight from Calcutta to London for different years. Table XVI gives the average monthly wages of labourers employed in tea gardens in Assam. Finally the last table, No. XVII, gives the rates of the import duties levied on tea in the principal countries of the world.

Five of the tables mentioned above have been removed in recent issues of this volume. Table X giving the total amount of indigenous and foreign tea available for consumption is omitted. The four tables giving information about the auction sales of tea in Calcutta and declared values of exports, etc., are compressed into two tables. The last two tables giving the average wages of labourers in Assam and rates of import duties in different countries are also removed. Thus in the latest publications there are only 12 statistical tables in Part II.

Coffee Statistics:—The early history of these statistics is the same as for the tea statistics. In the earlier years they related to the calendar year, but from 1908-09 they have been prepared for the year ending 30th June, because this date corresponds closely with the harvesting period. Though the method of collecting the data is the same as for tea, the figures are not so accurate because no information was obtained from plantations of less than 10 acres up to 1931. Since such plantations are numerous, the cumulative error is very high. But from 1931-32 plantations of between 5 and 10 acres have also been included in these figures, so that the error now is not so very high. The Government were so dissatisfied with the data collected that they stopped publishing this volume during the years 1910-11 to 1918-19. But this volume has been revived in an improved form with effect from 1919-20.

The statistical tables in this volume are very few when compared with those in the volume relating to tea. Only two tables are given at the end as an Appendix and the other relevant data are given in the corresponding sections of the report itself. The earlier issues, published under the title 'Note on the Production of Coffee in India,' contain information regarding the area under coffee and the reported production in the different provinces of British India and some Indian States. These were also expressed in the form of index numbers with 1885-86 as the base year. The exports to different countries of the world for five years ending with the year of report are given in another table. Imports of coffee by some of India's most important customers, namely the United Kingdom, France, etc. from different important coffee-producing countries like Brazil, are given. In the section on prices the price per cwt. according to the declared value of exports is given. These prices are also converted into index numbers with the year 1894-95 as base, for the purposes of comparison. The prices per cwt. and the corresponding index numbers for Brazilian coffee in

the New York market for different years are also given. Finally the import duties on coffee in different countries of the world at the time of report are given. This report has two Apendices. In Appendix I the area and reported production in important provinces of British India and Indian States with the totals for the whole of India are given. In Appendix II, this information is given by districts, together with the daily average number of people employed on the coffee plantations in each district.

In the revised issues from 1919-20 more prominence is given to statistical tables, and their number is increased to 5. The prefatory note gives a general account of the area, production, yield, trade, etc. in regard to coffee. The first two tables are abstract statements of the area and the production of cured coffee in each Province and State in India during each of the ten years ending with the year of report. In the third table details are given by districts of the net number of plantations and the total area and production of coffee and also the daily average number of persons employed. Table IV deals with the import and re-export trade in coffee with details as to the countries of origin and destination and Table V with the exports of coffee from India to foreign countries.

Rubber Statistics:—The publication of the annual statements regarding rubber began from the year 1919, and they refer to the calendar year. The method of collecting the data is the same as for tea and coffee. The report presents the statistical data in 6 tables.

Tables I and II are abstract statements giving the details of area and production respectively for the three kinds of dry rubber in important rubber producing British Indian Provinces and Indian States with totals for the whole of India. Table III gives details by districts of the number of rubber estates and the area and production of dry rubber in each district, and also the total number of persons employed on these estates.

Table IV gives details of the stocks of the three kinds of dry rubber in the different centres. Tables V and VI deal with the exports of rubber from and imports of rubber into India with details regarding the countries of destination and origin respectively.

The bulk of the acreage under rubber in India is in Travancore. Till lately, the mode of collecting crop statistics in that

State was defective, and therefore the figures given were not of great value. Recently, however, the Indian Rubber Licensing Committee made a thorough assessment of the acreage and thus we have to-day fairly accurate figures of rubber acreage.[3]

5. *Crop Forecasts.*

(This was dealt with in detail in the second chapter).

6. *Summary of Tables of Agricultural Statistics.*

Contents explained already

7. *Livestock Statistics.*

Early History.

As was the case with crop statistics, the collection and publication of Livestock Statistics was first undertaken at the instance of the Secretary of State for India. The Statistical Conference of 1883 fixed the forms in which the information was to be furnished. From that date a quinquennial census of the numbers of lifestock was taken and the results published in the Agriçultural Statistics of India, Vol. I. In some Provinces, an annual census was taken. Previous to 1920, the livestock statistics were very defective for several reasons. As in the case of crop statistics, the staff was not adequate for collecting these statistics in permanently settled tracts. It was not till 1912 that the first attempts were made to collect them in Bengal, and Bihar and Orissa, and even afterwards the figures for these two provinces were only based on estimates and not on actual enumeration. Things were not much better even in the temporarily settled ryotwari tracts, though they had been publishing some figures for a longer time. The census was entrusted to the overworked village karnam, or patwari, who used to take very little interest or trouble in the matter. The figures supplied were more in the nature of rough estimates than actuals. Another great defect was that they were taken at irregular intervals. The dates were not uniform in the different provinces and, even in the same province, the dates fixed for different districts varied.

The Government were aware of these defects, and in 1916 the Government of India decided in consultation with the Provincial

3. *Vide* Proceedings of the United Planters' Association of South India, 1934, pp. 70-81.

Governments to take a proper census of cattle in British India between December 1919 and April 1920, and to repeat it quinquennially. Thus the figures from 1920 only are strictly comparable. A quinquennial census is now taken in all provinces except the Central Provinces, where an annual census is taken. Therefore in the annual volume of Agricultural Statistics the figures of the census year are repeated for all provinces except the C. P. until a fresh quinquennial census is taken. There were variations in the date of second census in some Provinces. It should have taken place in 1924-25, but the Punjab took it up earlier, in 1922-23, and Bengal later, in 1926. A large number of Indian States also took part in the second census. All Provinces participated in the third census of 1929-30, but Bengal and Bihar did not join in the fourth census of 1934-35.

There are two kinds of errors in the Livestock Statistics, viz., errors of enumeration and errors of classification. The most serious charge made in respect of these statistics is that even in the temporarily settled ryotwari tracts, they frequently tend to be mere estimates by the village officers rather than the results of regular enumeration. Even granting that this allegation is very largely true, it would still be likely that the resulting total figure for such a large region as a Province would not be wide of the mark since underestimates in some villages would be likely to cancel out over-estimates in others. This applies to the main categories of livestock, namely cows, buffaloes, goats, sheep, etc., the total numbers of which are very large.[4] Even in regard to these the errors could be minimised by a closer scrutiny of the work of the village officers by the higher revenue officials. But in regard to the special classes of livestock, namely horses, mules etc., the numbers of which are relatively small, faulty methods of enumeration are bound to result in wide divergencies from the actual facts. A minor, but often serious, error in the totals occurs when the census is not taken in all areas simultaneously. At certain times of the year, when big cattle fairs are held, even inter-provincial movements of cattle take place and cattle are constantly moved between districts. Unless the census is taken simultaneously, there is sure to be some multiple counting of the same cattle. This could be avoided by fixing a convenient date for taking the census of livestock everywhere simultaneously, as is done for the census of population. The most serious mistakes are those connected with the

4. Royal Commission on Agriculture, Report, p. 613.

classification of the livestock. This is not surprising in a vast country like India, where interprovincial practices vary greatly and the definitions of the different classes are not very rigid. For example, the Punjab enumerator has to classify the cattle in twenty columns, whereas the Madras enumerator has to do it in eight columns. Naturally, the provincial figures will not be comparable if the definitions, e.g., the distinctions made between bulls, bullocks, breeding bulls, other bulls, etc., are not quite clear to the enumerators, so that they follow different methods of classification in the different provinces, as appears to happen at times. It is very desirable that an effort should be made to secure strict uniformity of classification, and the heads under which the returns should be made should be settled in an All-India Conference.

Agricultural Statistics, Vol. I, Table V.

In this table, the statistics of livestock are shown under eight major heads, namely oxen, buffaloes, sheep, goats, horses and ponies, mules, donkeys and camels. Oxen are divided under four sub-heads, namely bulls, bullocks, cows and young stock (calves), buffaloes under three sub-heads namely male buffaloes, cow buffaloes, and buffalo calves, and horses and ponies under three sub-heads, namely horses, mares and young stock. In the first table the provincial totals under the above categories are given for the current and the previous census. This is followed by separate tables for each province and the details are given by districts.

No statistics of the products of livestock have been collected, and this is a serious gap in our knowledge.

8. *Quinquennial Report on the Average Yield per acre of principal crops*

This publication dates from 1892, when a provisional return of the yield per acre of the principal crops cultivated in India was compiled from the various statistical publications available at the time, e.g., settlement reports, evidence before the Famine Commission, crop forecasts, etc. In 1893 the Government of India proposed that these estimates of yield should be revised by the respective Provincial Governments quinquennially mainly with reference to the results of certain crop-cutting experiments.

The Report covers all the Provinces of British India and Mysore State. It consists of two parts: part I is the general report and part II gives the statistical tables. The general report gives an account of the changes made in the figures of standard

yields for the different provinces at the quinquennial revision. For this purpose each province is dealt with separately, and details are given as to the number of crop-cutting experiments conducted, the agency which did the work, the defects to which the results are liable. Table I of part II is an abstract table giving the average yields for each of the sixteen principal crops during the several quinquennia beginning with 1893 separately for each Province and for Mysore State. The subsequent 15 tables, allotted one for each Province and one for Mysore State, give the particulars under the same heads as in the abstract table for the several districts in each.

The chief object of the crop-cutting experiments is to help in arriving at the normal out-turn in a year of average character. Any exceptionally good or bad seasons during a quinquennium should not affect the calculations of the standard yields, and no corrections are made in the previous figures unless the results show definitely that the corrections are necessary. In respect of irrigated crops separate estimates of the standard out-turn are made for irrigated tracts and for unirrigated tracts.

In the earlier years the district officers of the Revenue Department were in charge of the crop-cutting experiments. Since an examination of the results of the experiments during the quinquennium ending 1911-12 showed that they were unreliable, the Government of India recommended in 1915 that an officer of the Agricultural Department should supervise the crop-cutting experiments. But owing to want of staff and lack of interest in these experiments many of the provinces did not give effect to the change. The unreliability of the estimates is discussed in detail in the section dealing with 'standard yields' in chapter II. Recently, several of the Provincial Governments have taken this matter up seriously, and in the United Provinces and Madras a large number of experiments on a scientific basis are now in progress. It should soon be possible to obtain much more reliable figures for 'standard yields' as a result of these experiments.

9. *Intermediate Crop Reports.*

Besides the regular crop forecasts which are generally issued at an interval of two months, monthly intermediate crop reports are being issued from 1925 in between the regular forecasts. These reports which are mainly based on expert opinions of provincial authorities give no details but confine themselves generally to the effect of the season on the estimate of the condition of the crop

since the last regular forecast. These are published in the *Indian Trade Journal* as soon as received from provincial authorities.

10. *Crop Atlas of India.*

In 1923 the Department of Commercial Intelligence and Statistics published a Crop Atlas of India—which was reprinted in 1925—containing maps drawn on a scale of 1″ = 160 miles for each of the principal crops in India. These maps show by means of different colours the importance of the different districts in respect of cultivation of these crops. Inset tables are given in each map showing the average area and production of the particular crop in each province and States, and important ports of shipment are shown together with percentage shares of each port to total exports from India.

CHAPTER V.

SOME PRACTICAL PROBLEMS: THE NATIONAL INCOME

So far, we have considered agricultural statistics chiefly as commercial intelligence—a necessary help for the proper functioning of trade and the orderly marketing of produce. But agricultural statistics have other uses, and some of them are very important. The statistics of crops are essential for measuring the economic condition of a country. They are also a necessary guide in the formulation of economic policy. Whenever a country sets its mind on a plan of economic amelioration or national development, it is confronted with the need for accurate statistics of production, trade and consumption. Without the help of such statistics, the formulation of economic policy will be extremely difficult. Countries that devise plans without reference to statistics not only waste national resources but run serious risks. Similarly, if a country is to find out whether the economic policies adopted by it have succeeded or not, careful reference will have to be made to the relevant statistics.

Of the various criteria available for measuring the economic condition of a country, the national income is the most important. Marshall defines the national dividend as "the net sum-total of things and services produced." It includes only goods and services that can be measured in money, and thus many important items in economic welfare are excluded. Various anomalies arise from this mode of computing national income. Most valuable services like those rendered by mothers and wives are excluded from national income, but those of maid-servants are included; therefore, if some persons married their maid-servants, the national income would immediately show a decrease. Similarly, when the British M.P.'s came to be paid, the national income rose by £250,000. Valuable philanthropic services are not taken into account in the national income, but the most ordinary (even anti-social) services are included if they are paid for. Such difficulties have led some economists (notably the Hungarian, Fellner) to exclude services from estimates of national income, but this would make such estimates of little real value. As civilization advances, a smaller proportion of people in a country will be engaged in producing material goods, while a growing proportion will be engaged in supplying non-material goods as singers, preachers, artists,

lecturers, etc. The increase in the flow of enjoyable things makes a country richer and to exclude them from computation would make national income a poor indication of the nation's economic welfare.[1]

It must be admitted at the outset that national income is far from perfect as a criterion of economic welfare. To obtain a proper estimate of the national income we ought to measure all the goods and services available for the community and for the different economic groups composing it, but this is not possible, and in practice estimates of the national income take into account only such goods and services as are exchanged. In advanced industrial countries, where free goods and services are of little account, national income estimates may be fairly comprehensive ; this may also be so where large-scale agriculture is carried on, as in Australia and Canada. But in lands of small farming (as in India) where a large part of the goods do not come into exchange, and services are largely customary, estimates of national income must have serious limitations. In the sunny tropics, the requirements of heat and light and house-room are limited ; and many of the goods needed—water, fuel, building material—are comparatively free, at any rate in rural parts. In a peasant culture, the bulk of the crops are raised for consumption in the peasant's family, and only a small part of the produce (except in 'money crop' areas) goes to the market. The Indian social system also contributes to the same result. Can any one estimate the free services rendered in this country by one's family and caste in connection with birth, marriage, illness, funeral, apprenticeship of children, building and repairing of houses, and a host of other items which in other countries have to be paid for ? This largely detracts from the value of national income estimates in the case of countries like India which are still dominated by a rural economy of a fairly self-sufficient nature. Such estimates do not give any indication of the real measure of goods and services available, and the income figures of such countries cannot be compared with those of lands more advanced economically.[2]

The sum total of goods and services available is not a true measure of a country's economic welfare ; we must know the

1. Sir Josiah Stamp, in the *Journal of the Royal Statistical Society*, 1934, p. 425.

2. The error of making international comparison of incomes has been emphasised by Sir Robert Giffen (*Economic Enquiries and Studies*).

quantity actually available to people of various economic groups. At present we are content with figures of income per head, but these are mere abstractions and do not give any indication of the distribution of income.[3] The income per head may be high in a country like England, and yet a large proportion of the people may be poor and ill-fed. On the other hand, in a country like Denmark or Switzerland, the income per head may be comparatively low, but economic welfare may be more evenly distributed. Therefore, carefully drawn-up family budgets for members of different economic groups in the community will give a more accurate indication of economic welfare than mere figures of income per head. At any rate, what can be the value of figures of income per head estimated for India as a whole ?

A large part of the difficulty arises from the use of the money measure in estimating national income. With every rise and fall of the price-level, the national income estimate will also rise and fall, but this may give no true indication of the effect on economic welfare. This is particularly true of India where the bulk of the agricultural product is for consumption by the producer. Between 1928-29 and 1933-34, the total value of the principal crops of British India fell by about 53 per cent., but there was certainly no fall to that extent in economic welfare.

On all these grounds, the present estimates of national income are a poor index of a country's economic welfare particularly for agricultural countries like India. Thus, comparisons between the national incomes of different countries are deprived of real significance. The income estimates of the different countries are not comparable, and no safe conclusions can be drawn from them. The whole conception of national income is so vague and its measurement necessarily so inexact that many economists have discarded it as unsuitable for use in any accurate theoretical analysis.[4] Estimates of the national income may be of some use for watching the general trend of economic welfare in a country from year to year, but even for this purpose the estimates should be made carefully.

Income Estimates in India

The two principal methods of measuring national income are : (1) adding up the individual incomes, and (2) compiling the total

3. For the theoretical shortcomings of the per capita estimate, see Bowley, *The Nature and Purpose of the Measurement of Social Phenomena.*

4. Keynes (J.M.), *The General Theory of Employment, Interest and Money,* pp. 37-38.

value of goods and services. In countries where income and wage statistics are fairly complete, the income-summation method may be used with advantage, but where such statistics do not exist, we have to depend chiefly on an evaluation of goods and services. That is to say, we must add up the money value of the net products of agriculture, live-stock, industries, mining, fisheries, forests, etc., and evaluate the net incomes derived from trade, transport, the professions, public services and domestic service. In Great Britain both methods have been employed and the results tally fairly well. A census of production was taken in 1907 and it was repeated in 1912 and 1924. But for India, statistics of incomes and wages are available only to a very limited extent. Far fewer persons are assessed to income-tax in India than in Western countries,[5] and we have no means of estimating the incomes of the great majority. Accurate information on wages is also lacking. In these circumstances, we have to depend chiefly on compiling the total money value of goods and services. Some materials are available for this purpose at present, although not all of them are of the best quality. For estimating agricultural production, we have a system of crop statistics which in some ways is unique. We have also statistics of production of many organised industries from 1934;[6] but for unorganised industries which employ more than six-seventh of the industrial population, and for other important parts of national income—live-stock, fisheries, mines, forests, trade, transport and the professions—there are no reliable data in India at present.

We have indeed some statistics of agricultural production in India, but they cover only the larger crops and, even in regard to those crops, the production figures published cannot be entirely depended upon. They are based on the Government crop forecasts already described. These forecasts were originally started for revenue purposes (especially in temporarily settled tracts) and for giving indications about famine and distress. For such purposes these statistics are helpful, and they may be of some use for commercial purposes, although with many limitations, but as material for estimating national income they are of little use.

5. The assessees to income-tax in British India number only about 300,000. Even when the taxable minimum was Rs. 1,000, the number came to only about 700,000. Thus only one person in a thousand pays income-tax in India.

6. These figures are collected by the Statistical Branch of the Department of Commercial Intelligence and are published in the *Monthly Survey of Business Conditions.*

Attempts are being made to improve these forecasts as shown in Chapter II. If such measures are carried out satisfactorily, the outturn figures of these crops may become more reliable, but what about the numerous crops not included in the crop statistics ? For commercial purposes, information about a few leading crops may perhaps suffice, but for making estimates of the national income we require statistics of all the produce raised on land, including straw and subsidiary produce. There are many minor crops all over India which are important locally, and these must also be included. Timber, fruits and vegetables must not be left out. And for all these, not the wholesale prices paid at the ports but the actual prices received in the village must be entered, since otherwise there would be double-counting at various points.

The national income estimates made in India since 1900 are based on these agricultural statistics, supplemented by estimates of various items not comprised in them.[7] It was by utilizing these statistics that the Indian Central Banking Enquiry Committee estimated the agricultural income of India at Rs. 1,200 crores in 1928 ; and by adding 20 per cent. for subsidiary occupations, they arrived at an agricultural income of Rs. 42 per head.[8] Although they regarded this as only a rough estimate, it would have been proper to emphasise the inadequacy and unreliability of the data used. There are numerous pitfalls in the path of those who use these statistics. A Special Officer of the Madras Government in 1935 estimated the agricultural income of the Presidency at Rs. 11-12-0 per head, by adding up the outturn figures of the principal crops and by subtracting 40 per cent. from the total for cultivation expenses. It is not necessary to recount here the many mistakes of fact and accounting involved in this computation. As shown above, statistics of production are very incomplete and take no account of important items like live-stock. In converting gross income into net, the officer deducted cultivation expenses, but he thereby excluded the important item of wages which constitutes the income of more than a third of the agricultural population. No doubt he was justified in excluding land revenue, seed, manure, interest on capital, etc., but, by excluding such a large item of agricultural income as wages, he

7. Of the estimates made in the past—Dadabai Navroji (1870), Lord Cromer (1882) Digby (1899) Lord Curzon (1900) Wadia and Joshi (1913-14), Shah and Khambata (1921-22), and Findlay Shirras (1920-21, 1926-27) Rao (1925-29)—only the last few had the advantage of even such statistics.

8. Report, Vol. I, p. 39.

made his estimate of income unduly low. Yet he considered that his estimate was an optimistic one.[9]

Allied to agriculture are live-stock, fish, forest products, and the various unorganised industries pursued by the rural population. On all these we have very little reliable information. Perhaps the most important item among these is live-stock. In several agricultural countries live-stock is even more important than crops. It includes such large items as milk, butter, curds, hides and skins. In 1924, Dr. Gilbert Slater estimated the live-stock income of the Madras Presidency at Rs. 27·60 crores for the year 1919-20, or 9 per cent. of the total income.[10] Colonel Olver, Animal Husbandry Expert to the Imperial Council of Agricultural Research, has estimated the annual contribution of live-stock in India for 1929 at Rs. 1,900 crores, made up as follows[11].—

		Crores of Rupees.
Cattle labour in agriculture	..	612
Labour for purposes other than agriculture	..	161
Dairy products	..	810
Manures	..	270
Living animals exported	..	0·36
Other products	..	45·20
Total	..	1898·56

Colonel Olver does not claim any high degree of accuracy for his calculations, and one is inclined to think his figure an over-estimate, even as Dr. Slater's was an under-estimate. We have at present no adequate material for estimating the value of cattle labour, dairy products, manures, etc. Colonel Olver's estimate of milk and dairy products was based on the assumption that 24 gallons of milk was consumed (in the form of milk and products thereof) in India per head per annum—i.e. about 10 oz. per head per day. This is certainly an over-estimate for the Madras Presidency and perhaps for several other provinces. The estimated total consumption thus amounts to 39 million tons, which, valued at 1½ annas per pound, works out at Rs. 810 crores. Findlay

9. *Report on Agricultural Indebtedness,* by W. R. S. Sathyanathan, I.C.S., para 15 (Government Press, Madras, 1935).
10. *Madras Year Book,* 1923, pp. 788-91.
11. Note published by the I.C.A.R.

Shirras's estimate for milk for 1926-27 came to only 297,928 maunds valued at Rs. 223·44 crores. According to him, the total national income of India in 1926-27 was Rs. 2,804 crores and this has been regarded as a liberal estimate. It is therefore difficult to believe that the total income from livestock alone could have amounted to Rs. 1,900 crores in 1929.

An Economic Census.

It is clear from the foregoing that the existing data for estimates of the national income in India are faulty and altogether inadequate. In Great Britain, Australia and several other countries, total production has been computed by the census method. But unfortunately in the peculiar conditions of India, it is not possible to collect figures by means of a census of the kind in use in those countries. Except in the case of organised industries and plantations, it is practically impossible to get the producers to fill up schedules. The average ryot and artisan cannot be expected to fill up such schedules. A census of a different kind will have to be attempted in the case of agriculture and handicrafts which employ the great majority of the people of India

The census to be undertaken should be primarily on the basis of production, but it should be supplemented by a summation of incomes in the case of services and those occupations for which income cannot be recorded in terms of produce. The unorganised industries of India are so intimately connected with agriculture that a survey of the two will have to be made together. Nor is the difference between rural and urban life so great in India as in most Western countries. A simultaneous census should therefore be taken both in villages and in towns. It is not possible to make an economic survey of every village and town; nor is it necessary, seeing that a survey of a fairly large number of them selected on the random sampling basis would give us as accurate an estimate as is necessary.

The two British economists who visited India in 1934 on the invitation of the Government of India (Dr. Bowley and Mr. Robertson) have suggested a fairly comprehensive scheme for an economic census.[12] It consists of the following parts:

1. A rural survey of 1650 out of the 422,000 villages of British India selected on the random sampling basis. Each village would be surveyed by a full-time investigator for a whole year.

12. *A Scheme for an Economic Census* (1934).

2. An urban survey of 30 to 40 out of the 1,603 cities and towns of India classed under that category in the census of 1931. This would cover about 8 millions out of the 28 million urban dwellers in British India.

3. An intermediate urban census of population.

4. A census of production in the case of factories using power, mines and some other industries.

The cost of the whole survey was estimated at Rs. 30 lakhs made up as follows:—

		Rs.
Census of production	..	2,00,000
Rural survey	..	22,00,000
Urban survey	..	3,00,000
Urban census	..	2,00,000
Report	..	1,00,000
Total	..	30,00,000

It is proposed to deal here only with the rural survey, which will necessarily be the largest of the various undertakings. The experts' scheme is based on excellent principles, but its large cost has alarmed many persons. According to Dr. Bowley's note, "the annual net income of each family in the village" should be ascertained.[13] That would mean working out a balance-sheet for each of the 300 or 400 families in a village and this would be too difficult for even the most diligent investigator.

For the purpose we have in view, such a summation of individual incomes is not necessary. The method we have suggested is not income-summation, but an aggregation of goods and services. This can be done without drawing up a balance-sheet for each family. We can add up the total production of the village before the produce goes to the houses. In the case of cereals, which account for about 85 per cent. of the total sown area, there are two harvesting seasons in most parts, and as threshing is done on a few large common threshing floors in most villages and the produce is generally measured or weighed before it leaves the floor, especially where (as in the *batai* or *varam* tenure) the produce is shared between landlord and tenant, the actual produce from each field can be ascertained at the threshing floor without any great diffi-

13. *Op. cit., pp.* 70-7.

culty In many parts of the country, the weighing and measuring of produce is done by one man (or a few men) for the whole village, and such men could estimate produce accurately even before the crops are harvested. Some of the leading men of the village would also be able to estimate fairly correctly soon after the harvest how much produce was raised from each holding.

The advantage of counting up the produce in this way is clear. Cultivation may be regarded as a joint undertaking by landlords, tenants and labourers. The shares of all these partners in the business are in the grain-heap. Once it is distributed between the partners, it will be extremely difficult to obtain correct totals. Most people are unwilling to disclose such facts, and labourers are unable to say how much they receive in a year. Therefore a house-to-house survey would yield poor results. But if we count the produce at the source, these difficulties can be minimized and the work of the investigator will become comparatively easy. The village grain-heap is the fund from which the whole agricultural population draws its income and, if it is correctly measured, we shall get the essential data for estimates of the national income.

By a procedure more or less similar, we may also estimate the gross out-turn under pulses, oil-seeds, cotton, jute, sugar-cane, and other crops. The traders and the professional weighing men in the village should be utilized for verifying the estimates. They are the most competent persons for compiling statistics in the village and their services would be invaluable in a rural economic survey.

Next the gross outturn should be converted into net by making certain deductions, the first of which is land revenue. Wages need not be deducted, as they form the income of the labouring classes. Seed and interest on capital may be deducted, but if they are deducted the income of seed merchants and moneylenders should be estimated and added in separately. A practical solution will be not to deduct them unless they go out of the village. The produce going out of the village as rent or wages should also be deducted and the corresponding amounts coming into the village should be added to the total. The whole net amount should then be evaluated in money at the prices received in the village. To this must be added the estimated value of straw (excluding the part reserved for the cattle),[14] minor crops, fruits and vegetables, timber, fish and forest produce, eggs and poultry, milk and milk

14. Dr. Slater excludes straw on the ground that it forms fodder for plough cattle, but not all the straw is so utilised.

products, hides and skins, horns and so forth. The value of standing crop of fruits and vegetables can be estimated by experienced persons, and the milk supply should be computed by studying the yields on a sample basis. The value of the labour of cattle need not be estimated as it is included in the grain heap. The income of weavers, spinners, carpenters, mat-makers, cartmen, etc. in the village should also be assessed and added. Finally the incomes received by blacksmiths, dhobis, barbers and village functionaries for services rendered by them (excluding customary payments made for help in the productive process) must also be included. Remittances going out of the village should be deducted from the total and remittances into the village should be added to it. Thus we shall get the total income of the village.

On the basis of such village totals, we could estimate the agricultural production and income of the country. But this method would not provide much information about the distribution of the income from agriculture among landlords, tenants and labourers. Such a division of the national dividend is important in countries where there is a clear demarcation between these three classes, but in the case of India the dividing-line between the cultivator and the labourer is very difficult to draw; many peasants do their own labour and even work as day-labourers for others when their labour is not needed on their own holdings. The amount going out of the village as rent is important, and this figure could be obtained from the data collected on the plan described above.

As has already been shown, family budgets are the most suitable means of measuring the economic condition of the community and of the different groups composing it. It is therefore necessary to collect, from all villages surveyed, budgets of families selected from each economic group on the random sampling basis. In order that the budgets may give a clear idea of the real income and standard of living of the various classes, provision should be made for obtaining full details of the food, clothing and houseroom used by the different economic groups. Family budgets would also supply ample data for measuring the distribution of the national dividend and the quantity of goods and services which the different grades of income can command.

With the help of the Universities and the active co-operation of the Departments of Revenue, Agriculture and Co-operation, the cost of such a census could be kept within reasonable limits. If a thorough census is taken once, the cost of future censuses will not

be considerable. India has lately taken a step forward in constitutional development and in every province there is keen interest in rural uplift. This is just the time to make an economic survey of the whole country. It would provide very valuable data for drawing up plans for a general economic advance, and it would also provide a starting point from which we could measure in future the success of the various efforts at rural amelioration which have lately been inaugurated in many parts of the country.

CHAPTER VI.

SOME PRACTICAL PROBLEMS: POPULATION AND FOOD-SUPPLY

We have seen in the last chapter that the agricultural statistics now available in India are insufficient, both in quantity and in quality, for making a reliable estimate of our national income. Are they equally defective in the matter of estimating the adequacy of our food-supply ? There is now a growing belief that the food-supply of India has not been increasing adequately for the proper sustenance of the teeming millions of this country. The large increase of population in the last decade (10·6%) has been quoted in support of this view. Population has been growing rather fast, but food-supply, they say, has not been increasing at anything like that pace. Some persons think that there is a shortage of food-supply, and they fear that disaster may overtake India if population is allowed to grow at the present rapid pace. Such alarms have been sounded not only by private individuals but by some high-placed officers of the Government in India. What light do the available agricultural statistics of India throw on this question ?

1. *Adequacy of Food-supply.*

In order that we may be able to make any safe conclusion on the adequacy of the available food-supply, we must know (1) the total quantity of foodstuffs available for consumption and (2) the actual diet requirements of the people. It is possible to estimate in a general way the quantity of foodstuffs available for consumption, but unless we know how much is actually required by the people we shall not be in a position to judge about their adequacy. Unfortunately we have no satisfactory data on either of them and those who have lately made alarming statements have only made guesses, and their conclusions are drawn chiefly from general impressions.

The defects of the present crop statistics are clear from the details given in the previous chapters. They were drawn up originally for purposes of revenue assessment and although improvements have been made later with a view to making the forecasts helpful for commercial purposes, they are still in an imperfect state. At any rate, they cannot be used for estimating the adequacy of food-supply; for, not only are they often inaccurate but

there are very important lacunae which impair their usefulness. Our statistics of cereals are fairly complete, but they are generally regarded as underestimates.[1] Further, they exclude several Indian States, and as all India forms a unit for consumption purposes this is a serious defect in our statistics. Again, cereals form only a part, although an important part, of the total food-supply of the country. The normal dietary comprises not only cereals but pulses, green vegetables, legumes, berries, fruits, nuts, roots, fish, meat, milk and milk products ; but on all these, information is lacking or highly defective. In some parts of the country (e.g. Malabar) certain vegetables and roots form at least as important a part of the dietary as cereals, and not to include them would give a very wrong idea. In recent years, the use of fruits and vegetables has considerably increased but we have no accurate information about their quantity. How then can we estimate the total food-supply ?

Coming next to the actual food requirements of the people, one finds that information is even more meagre. In the West, a new technique has lately been devised for testing the adequacy of diets. On certain assumptions concerning the time taken by people for work, rest and sleep, it has been estimated by physiologists that 'an average man at average work' should have 3,000 calories per day. Of milk alone, there must be 35 ounces daily. But obviously such diet standards devised for European countries cannot apply to a mainly tropical land like India, and therefore physiologists have tried to work out diet standards applicable to this country. One such estimate is that of Nichols, according to whom an agricultural labourer belonging to the tropics needs 2200 calories per day. Dr. Aykroyd, Director of the Food Research Laboratories at Coonoor, has been engaged in researches in this direction, and although he has not made any final conclusions on this point, he inclines to the view that the 'minimum calorie requirements' per consumption unit of South Indian peasant families lies in the neighbourhood of 2,500. Others think that these are all over-estimates. The calorie requirement must depend on several factors, including the nature and duration of work, the weight of the body, and so forth. Admittedly, the body-weight is lower in India, and in rural areas only the labouring classes do anything like hard work. According to one authority, the average body-weight in India being below 120 lbs., the total requirement would be only 1,800 calories per day

1. Vide infra.

at the rate of 15 calories per lb. of body-weight.[2] Thus the matter still remains obscure. Further, there are also large lacunae in our knowledge of the composition and digestibility of several of our foodstuffs.

In spite of such defects in our knowledge of the food requirements of the people of India and the quantities of foodstuffs available, various estimates have been made. One of the boldest of them is that of Prof. Radhakamal Mukerjee who finds a calorie shortage of 41·1 billion calories. According to him, India's present food-supply is 280·4 billion calories, but the food needs are 321·5 billion calories. He therefore concludes that as many as 48 million people in the country must be going without food.[3] But the assumptions on which he bases this conclusion are rather slender.

Although the data available are not adequate for so precise a computation of the total food-supply as the above, it is possible even with the existing material to estimate the adequacy of certain principal foodstuffs.

In the tables 1 and 2 below is given an estimate of the total supply, and supply per head of population, of the principal food grains (rice, wheat, jowar, bajra, ragi, gram and pulses) in the various provinces of India during the period 1934-35 to 1938-39. Table 3 gives the percentage consumption of the different cereals.

2. Sir Alfred Chatterton at the East India Association, *Asiatic Review*, October 1937, p. 731.

3. *Food Planning for Four Hundred Millions*, pp. 23-6.

TABLE 1.

Average net supply per annum of food grains and pulses in India.

Province.	Population. (000)	000 tons. Rice.	Wheat.	Jowar and Bajra.	Ragi.	Other Cereals (approx.)	Total supply (1,000 tons).
Madras*	45,000	5,368	83	1,635	798	430	8,314
Bombay	17,916	1,235	501	2,027	204	183	4,150
Bengal	50,123	8,634	255	4	2	51	8,946
Bihar	32,588	2,532	480	44	177	866	4,099
Orissa	8,000	1,350	5	14	75	7	1,451
C. P. & Berar	15,508	1,492	646	824	4	150	3,116
Punjab	13,332	353	2,635	448	6	594	4,036
Sind	3,887	324	247	190	..	7	768
United Provinces	49,615	2,175	2,539	894	80	2,757	8,445
India	346,409	27,846	9,580	8,769	1,770	8,000	55,965

*Excluding Orissa.

TABLE 2.

Supply, per head of population, of the various food grains (cwt.)

	Rice.	Wheat.	Jowar and Bajra.	Ragi.	Other Cereals	Total cwt.
Madras	2·39	0·02	0·73	0·35	0·19	3·68
Bombay	1·38	0·56	2·26	0·23	0·20	4·63
Bengal	3·44	0·10	..	..	0·02	3·56
Bihar	1·56	0·29	0·03	0·11	0·53	2·52
Orissa	3·38	0·01	0·03	0·19	0·02	3·63
C. P. & Berar	1·92	0·83	1·06	..	0·19	4·00
Punjab	0·53	3·96	0·67	0·01	0·90	6·07
Sind	1·72	1·27	0·97	..	0·04	4·00
United Provinces	0·87	1·02	0·38	0·03	1·11	3·40
India	1·61	0·55	0·51	0·10	0·45	3·23

TABLE 3.

Percentage consumption of different cereals.

	Rice.	Wheat.	Jowar and Bajra.	Ragi.	Others.	Total.
Madras	65	1	20	10	4	100
Bombay	30	12	49	5	4	100
Bengal	97	3	—	—	—	100
Bihar	62	12	1	4	21	100
Orissa	93	—	1	5	1	100
C. P. & Berar	48	21	26	..	5	100
Punjab	9	65	11	..	15	100
Sind	43	32	24	..	1	100
United Provinces	26	30	11	1	32	100
India	50	17	16	3	14	100

Sir John Russell, in his report on agricultural research submitted to the Government of India in 1937, has made an estimate of the grains available in each Province. He includes not only cereals and pulses (as in the above tables), but also oilseeds which are consumed by the people in one form or another. Cotton seed is not included. His conclusion is that the supply per head per day of all grains in most provinces is about 20 to 22 oz. ; this would give a daily calorie value of about 2,000 or 2,500 according to the proportions of oilseeds taken, and a nitrogen supply of 12 grams daily.[4] The table of Sir John Russel is quoted below :—

TABLE 4.

Production in oz. of all grains, including pulses and oil seeds per head per day.

Province.	Total grain million tons.	Population millions.	Total grain oz. per head per day.	Nitrogen grams per head per day.
Assam	1·6	8·6	18	7
Bengal	9·3	48·9	19	7
Bihar & Orissa	9·0	36·7	24	11
Bombay	6·1	20·6	29	16
Central Provinces	4·8	15·5	30	15
Madras*	10·4	46·7	22	11
Punjab	5·0	23·6	21	12
United Provinces	10·6	46·7	22	13

4. *Report on the work of the Imperial Council of Agricultural Research in Applying Science to Crop Production in India* (1937), p. 17.

* Includes groundnuts which forms 20 per cent. of the whole.

One thing, at any rate, is clear from the available statistics : there does not seem to be any serious shortage of cereals in India (except that in the case of rice a small part of the quantity available comes from outside). On the other hand there is some evidence that certain classes are consuming more of cereals than is necessary or desirable. What is really needed is a more balanced diet, and for such a diet, we need more of vegetables and milk than is now available. Perhaps the most disquieting fact about Indian diet is that there is a serious shortage of milk and milk products.

If a more precise estimate of the food position in India is needed we have first of all to improve our agricultural statistics, both in quality and quantity. Crop statistics must cover all crops, especially food crops. It is also necessary to improve our knowledge of the food requirements of the people and of the food actually consumed. Hence the importance of carrying out sample food surveys in all provinces. The researches of Dr. W. R. Aykroyd at Coonoor are extremely important in this respect and valuable results can be expected from them. It is primarily for the Provincial Governments to improve crop statistics ; the central statistical bureau can only work up the figures collected by the Provincial Governments.

2. *Trend of Food-Supply, 1911-1934.*

All that we may therefore do in the present circumstances is to compare population and food-supply during a period of years. This cannot help us to test the adequacy of the present food-supply, but it will enable us to find out if lately food-supply has become comparatively less adequate than a few years ago. The claim is often made that conditions have lately become worse than before and hence the importance of such an enquiry.

Area as the Criterion.

The most familiar way of studying the trends is to compare population growth with the increase in acreage under cultivation. This is a rather unsound method, because the bare acreage figures give no indication of the nature of tillage, the adequacy of water-supply, the state of crop rotation and other material factors. It is well known that certain improved crops give a far higher income from an acre of land than the old ones. For instance, the yield of the Coimbatore cane is considerably more than that of the older varieties. Especially in commercial crops, the cultivation of improved varieties has greatly increased in recent years, as will be seen from the table below :

TABLE 5.

Approximate proportion of the area sown with improved seed.

Crop.	Total acreage (million acres)	Acreage under improved crops (million acres).	Percentage.
Sugarcane	4·00	3·22	80·0
Jute	2·18	1·12	50·0
Wheat	33·61	6·96	20·6
Cotton	26·00	5·04	19·2
Rice	83·43	3·58	4·3
Groundnut	5·86	0·22	3·4

It is clear from the above that at least in the case of crops like sugarcane and jute, the mere acreage figures give little indication of actual production. To the extent that new crops have come into vogue the old standard yield figures ought to have been modified, but this has not been done in most places. This partly explains the underestimating that has been repeatedly going on, especially in certain money crops.

The state of water-supply is also equally important and the progress of irrigation has increased the production from land. With better irrigation facilities, sugarcane can be substituted for rice on some lands, and when this takes place, the income from land may be three or four times what it was under a rice crop. Even if there is no change-over to another crop, a regular supply of water enables the cultivator to make the culture more efficient and to have a better rotation of crops. It is true that between 1901 and 1930 the total cultivated area rose only from 200 million acres to 229 million acres (14·5%), but in the meantime the irrigated area increased by 45%, i.e. from 33 million acres to 50·5 million acres. To-day, a little more than a fifth of the total cultivated area is under irrigation. Therefore comparisons based on acreage figures are of very limited value to-day.

We are often reminded that the acreage under foodstuffs in India is only three-quarters of an acre per head. This may no doubt be small if agriculture continues as formerly. But with improved crops, a better rotation and a more efficient tillage, India may have ample food-supply even if the acreage under food crops falls below three-quarters of an acre per head. Japan has only a third as much per head under food crops, and whatever may be the difference between Japanese and Indian conditions,

there is no need for anxiety provided our agriculture is progressive. With more efficient tillage, we may with advantage devote for dairying, vegetables and fruits, part of the land now under cereals. (*Vide* infra).

Production as the Criterion.

A much more suitable method is to take the trends of food-supply during a given period. This will be a more reasonable mode of comparing the growth of population with that of food-supply. For the purpose of such a comparison, the deficiencies of crop statistics mentioned above are not quite serious, because the errors are more or less *systematic.* If the annavari estimates are mere guesses, they have been so more or less for the whole period. If the acreage figures are inaccurate for certain areas, they have been so for the whole period under consideration. Therefore whatever error there is, is common for the whole period. For, what we are in search of is not the total food-supply available, but the increase or decrease of it to keep pace with an increasing or diminishing population. Our crop statistics may be defective for the former purpose, and generally unhelpful as commercial information, but they are helpful for time comparisons, as we are only dealing with 'relatives'. Such a comparison is not free from defects, but it is useful for watching the trends.[4a]

For purposes of such study, the period before 1911 cannot be taken because production statistics of that period excluded certain areas, both in British India and in the Indian States, and as those areas came to be included by 1911, the figures of the two periods are not comparable.[5]

In the tables below, the period 1911-34 is taken. In Table 6 are given quinquennial averages of the supply of food-stuffs available

4a. Owing to the well-known defects of Indian agricultural statistics, some writers (e.g., Gyan Chand, *India's Teeming Millions,* p. 287) discredit them altogether for all comparison purposes. This attitude is not justified. While our statistics are defective for measuring total food supply, they are quite valuable for time comparisons, provided the period before 1911 is not taken.

5. This is a defect in the calculations of certain writers who accept the statistics of the whole period as comparable; see for instance, Karve, *Population and Poverty in India* (Ch. IV). It is possible to exclude the production of the newly added areas, and thus make a more correct comparison. This has been done in my paper on "Population and Production in India," (*Indian Journal of Economics,* April, 1935).

for consumption in India including Burma (production *plus* import *minus* export). In Table 7, the corresponding index numbers are given. See also graph on p. 91.

TABLE 6.

Quinquennial averages of the principal food-stuffs available for consumption.
(quantity)

(in millions of tons.)

Year.	Rice.	Wheat.	Barley.	Maize.	Bajra	Jowar.	Gram.	Tea.	Sugar.
1911-14 (4 years)	26·40	8·24	3·07	1·94	1·96	3·95	3·21	17·01	2·43
1915-19	30·44	8·53	2·97	2·30	2·32	4·93	3·51	39·90	2·86
1920-24	28·35	8·8	2·74	2·04	2·36	5·63	4·05	41·88	2·81
1925-29	27·39	8·55	2·34	2·09	2·51	6·48	3·35	43·60	2·98
1930-34	30·02	9·53	2·37	2·18	2·49	6·46	3·60	42·77	4·20

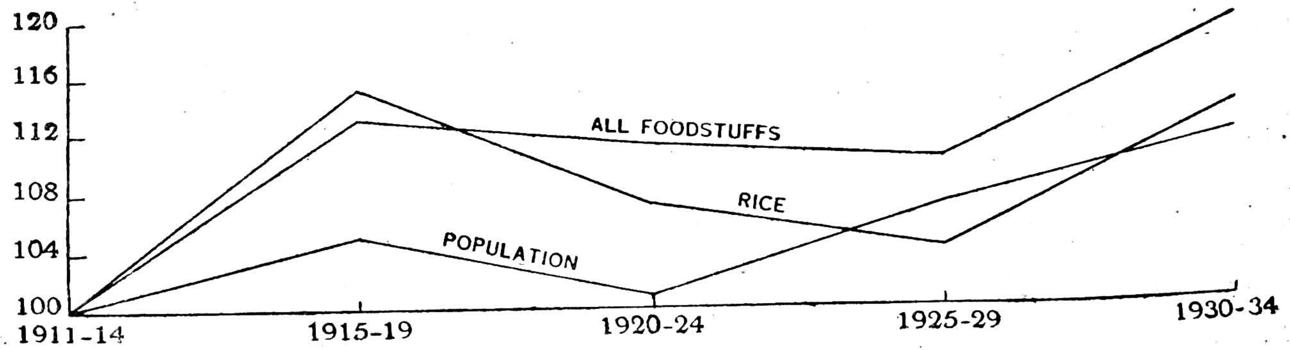
TABLE 7.

Food-stuffs (quantity)—Index Numbers

Commodity.	Weight.	1911-14	1915-19.	1920-24.	1925-29.	1930-34.
Rice	52	100	115	107	104	114
Wheat	15	100	104	107	104	116
Barley	5	100	97	89	76	77
Maize	3	100	118	105	108	112
Bajra	4	100	118	120	128	127
Jowar	8	100	125	143	164	164
Gram	7	100	109	126	104	112
Sugar	6	100	118	116	123	173
All Commodities		100	113	111	110	120
Population		100	105	101	107	112

In the above tables, both population and food-supply are taken for five-year periods. Population increased only 12 per cent between the periods, for although the increase was 10½ per cent in the decade 1921-30, it was only 1·2 per cent in the decade 1911-20, and therefore during the whole period taken the increase was only

CHART SHOWING INDEX NUMBERS OF POPULATION AND FOOD STUFFS IN INDIA.
QUINQUENNIAL AVERAGES WITH 1911-14 AS BASE.



12 per cent. (It is assumed that population increase between 1931 and 1934 was at the same rate as in the previous decade). Even if we take the period of thirty years from 1901 to 1931, the increase was only about 18 per cent or ·6 per cent per annum. The food-supply has evidently kept pace and has not lagged behind. Only in regard to barley has there been a fall, but it is a minor article of diet. Rice has just kept pace, the increase being 14 per cent between the two periods, as against the population growth of 12 per cent. The supply of millets—the labourers' food—has increased, bajra by 27 per cent and jowar by 64 per cent. The supply of sugar has increased by 73 per cent. But the large increases in the minor foodstuffs have not been allowed to influence the general conclusion, because proper weights have been assigned to each crop as will be clear from the table. The weight assigned for rice is 52 units while the weights for jowar and sugar are only 8 and 6 respectively. There has been a rapid increase in the consumption of tea in recent times and if tea also had been included in the above estimate, the index figure would have been higher.

These conclusions have been borne out by calculations made by others. Sir David Meek in a valuable paper which he read before the *Royal Society of Arts in 1936* comes to a similar conclusion. He took the period 1909-10 to 1913-14 as the base of his calculations, and came to the conclusion that production under food crops increased by 21 per cent during the period, while all crops increased by 19 per cent. His table is given below.[6] He also shows that while population increased only 0·60 per cent per annum even taking the period 1901-31, agricultural production increased by 0·65 per cent per annum from 1909-1934, mineral production by 2·7 per cent per annum (from 1904 to 1933) and industrial production by 2·5 per cent per annum from 1909 to 1932.

6. *Journal of the Royal Society of Arts*, June 1936 (Vol. LXXXIV), p. 844.

TABLE 8.

Index Numbers of Volume of Crop Production in India. (1909-10 to 1913-14). Base=100.

Average of 5 years.	All crops.	Food crops.	Other crops.
1909-10 to 1913-14	100	100	100
1914-15	105	101	121
1915-16	106	109	92
1916-17	117	119	10
1917-18	118	121	103
1918-19	84	82	94
1919-20	113	111	123
1920-21	90	92	83
1921-22	108	114	82
1922-23	114	118	97
1923-24	107	105	114
1924-25	111	108	123
1925-26	112	108	128
1926-27	112	108	130
1927-28	109	104	133
1928-29	116	113	129
1929-30	117	115	126
1930-31	118	117	124
1931-32	112	118	87
1932-33	116	119	104
1933-34	119	121	110

Although Dr. Radhakamal Mukerjee has given expression to somewhat pessimistic views about the inadequacy of foodstuffs in India, his estimates of the trends of food-supply are even more favourable than ours or Sir David Meek's. He takes the period from 1910-11 to 1914-15 as the base and comes to the conclusion that while population increased 17 per cent by 1932-33, the production of food crops increased by 34 per cent and all agricultural produc-

tion by 27 per cent.[7] In this table, he takes the quantity of production, but in another table he takes the available supply by deducting exports and adding imports of food, and even according to this calculation, while population increased by 17 per cent by 1932-33, food production (weighted) increased by 24 per cent.

It is not claimed that all these conclusions are such as to set at rest our fears about our economic position; all that they indicate is that our food production has at least kept pace, and that whatever food deficiency there was in the period 1909-13 has not increased.

3. *Food-supply not an Adequate Test.*

It may be remarked at this stage that comparisons of population and food-supply can only give a very partial view of the economic condition of the people. Total production, both agricultural and industrial, must be taken into account in order that we may have a proper view. There are certain special circumstances regarding our production which make this essential. Formerly, this country had a fairly large export trade in rice and wheat, but with the growth of cheaper supplies of foodstuffs elsewhere, India's exports have diminished. In respect of rice, the exports have greatly declined and India has become a net importer, especially from Burma whose virgin rice fields are able to produce abundant quantities of paddy at a comparatively low cost. The acreage under rice in India has therefore been remaining rather stationary. The table on p. 95 will make all this clear.

7. Index numbers of Population and value of Crop Production in India.

Average of Years.	Population.	All Crops.	Food-Crops.	Non-food-crops.
1910-11 to 1914-15	100	100	100	100
1918-19	105	104	95	114
1921-22	100	109	125	94
1928-29	103	138	123	154
1931-32	114	149	133	166
1932-33	117	127	134	121

TABLE 9.

Production, Net Imports and available supply of Rice in India. (Excluding Burma)

	1933-34.	1934-35.	1935-36.	1936-37.	1937-38.	1938-39.
Area (000 acres)	70,340	69,731	70,998	72,295	72,277	
	(000 tons)	(000 tons)	(000 tons)	(000 tons)	(000 tons)	(000 tons)
Production according to forecast		25,729	23,271	28,253	26,763	23,577
Add for Provinces not included in forecast		960	1,124	989	935	935
Estimated production		26,689	24,395	29,242	27,698	24,512
Exports (by sea)	217	206	191	235	229	283
Imports (by sea):—						
(a) Foreign countries	87	357	170	63	2	18
(b) Burma	1,474*	2,311*	1,692*	1,787*	1,220	1,320
Imports by land frontier	50	50	50	50	50	50
Total imports	1,611	2,718	1,912	1,900	1,272	1,388
Net imports	1,394	2,512	1,721	1,665	1,043	1,105
Net supply		29,201	26,116	30,907	28,741	25,617

*Calendar year.

Note: Paddy is converted into rice at ⅔ of the weight of paddy.

Thus India depends on external supply to the extent of 5 to 8% of her rice supply. Let us note, however, that while the production of rice has diminished, the production of various cash crops has increased. The increase under sugarcane is particularly noteworthy, but there has been increase in export staples also. After the War (1914-18), India exported larger quantities of cotton, groundnut, jute and tea than previously, and the export of manufactured goods like cotton piecegoods and jute manufactures also increased.

TABLE 10.

Exports of certain commodities at various points

Commodity.	Pre-war average	Post-war average	1936-37
1. Raw cotton (million bales)	2·40	2·91	4·14
2. Cotton piecegoods (coloured & printed) (yards)	42,000	121,000	112,000
3. Jute (gunny), (million)	9·70	12·70	17·10
4. Tea (million lbs.)	266	321	305
5. Groundnut (000 tons)	211	195	740

This indicates a growing commercialization of our agriculture. More attention has been given to commercial crops like cotton, sugarcane and tobacco which bring in more money, and this cannot be considered unwise seeing that it increases the income from agriculture. Normally land must be devoted to the most profitable use and the preference for the several crops will depend on the comparative intensity of demand for land. Military considerations, however, have lately come to override the economic motive and several countries in Europe have taken to raising crops for which they have no comparative advantage. In future, India may also be compelled by military necessity to grow more rice. But it would be wise to increase the yield from the present rice acreage by the use of more manure and better seeds rather than to substitute rice for other crops. It may also be possible to increase the acreage under rice by extending irrigation in certain tracts.

It is also necessary to keep in view the diet position of the country. In the opinion of specialists, the diet of India is overweighted on the side of rice and other cereals, and deficient in dairy products, fruit and green vegetables. Therefore a more important objective than increasing rice supplies is to add to the area under fodder crops, vegetables and fruit trees. Rather, following the advice of Sir John Russell, we must try to increase the yield from the existing acreage under staple crops so as to liberate land for dairy production, vegetables and fruits.[8] This, then, should be regarded as the prime objective of crop-planning in India.

8. Russell's Report, p. 20.

Not food-supply but income—real income—is therefore the proper test. In assessing the growth of income, we have to take stock not only of agricultural production but of mineral and industrial production also. According to Sir David Meek, mineral production (salt, petroleum, iron ore, manganese, mica, coal, saltpetre, lead, tin ore, and copper ore) has increased by 59% since the period 1909-13.[9] As for industrial production, the growth has been striking. Before 1914 India imported nearly the whole of its sugar, iron and steel goods, cement, and paper, and three-fourths of its cotton piecegoods, but to-day this country produces nearly all its sugar and matches, two-thirds of its iron and steel goods, and three-fourths of its cotton piecegoods and a good part of its cement. The increase, especially in sugar, has been phenomenal.

This subject does not enter into the scope of the present work; further, statistics of industrial production are not available for earlier years. Even those for agricultural production are rather imperfect for the period before 1911. Therefore in the following table figures are given only for the period after 1920-21. In it agricultural production includes rice, wheat, sugar-cane, tea, cotton, jute, linseed, rapeseed, sesamum, groundnut, indigo, coffee, rubber, jowar, bajra, maize, gram and barley and industrial production includes cotton yarn, cotton cloth, jute cloth and gunny bags, sugar, coal, cement, paper, iron and steel. Indices for production for the biennial periods were arrived at by Fisher's weighted aggregate index method. (Vide Tables VIII and IX).

	1920-21 to 1921-22. (Average).	1934-35 to 1935-36 (Average).
Population	100	115
Agricultural Production	100	121
Industrial Production	100	267

Evidently, industrial production is growing fast and in future, to take only foodstuffs or even all agricultural production would give a very inadequate picture of India's economic condition.

9. *Journal of the Royal Society of Arts,* June 1936, p. 842.

4. *Conclusion.*

Although the facts given above do not justify the high degree of pessimism revealed by some writers, they do not justify any optimism either. That poverty and misery are widely prevalent in India needs no proof. A considerable number of persons in the country are under-nourished; perhaps more are suffering from malnutrition. Sir John Megaw's enquiries showed that only 40 per cent of the people of India were well-nourished and 60 per cent ill-nourished. This may be true, but this may not be due only or even chiefly to a rapid increase in population or a serious lag in food-supply, as is widely believed; rather it may be due more to a bad distribution of the present income. It certainly is due to the imperfect development of our resources and to the unemployment and under-employment prevailing in the country. Therefore, the remedy lies in our overhauling our economic system. Our production and our economic system as a whole must be reconditioned on a more equitable distributive ideal. This will increase our wealth and income. The standard of living will then rise, all idle labour will be fully employed and all will have enough not only of food, but of clothing, house-room and recreation. This is the central economic problem of India and must be tackled with all the powers at our command.

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APPENDIX A.

CROP-CUTTING EXPERIMENTS: THEORY

The importance of crop-cutting experiments in fixing the standard yield of crops in different regions has been shown in the second chapter.

The chief requirements of a satisfactory sampling process are: (1) the sample must be properly representative of the material sampled and (2) a valid estimate of the sampling error must be available. In order to satisfy the first condition the selection of the units must be uninfluenced by the qualities of the objects sampled and free from any element of choice on the part of the observer. Dr. Yates has pointed out the defects of non-random selection in a paper on *Some Examples of Biassed Sampling.**

In his first example on the bias in the height measurements on wheat, it was pointed out that when the shoots were low, there was a tendency to pick the higher shoots, but when they have come to ears, the observers tended to select shoots somewhere near the average, omitting both very high and very low values. In the second example, on the sampling yield of wheat, when the actual yields of the whole fields were compared with those estimated from a few cuttings here and there, a positive error varying from 13 to 35% was found, and this was mainly attributed to the lack of randomisation in selection. A similar result was noted in the third example which is also a sampling experiment on wheat yield. The evidence of the above three experiments brings out that when any element of personal selection is exercised, the results will be biassed and a well designed method of random sampling would give considerably more accurate results for the same amount of work.

The simplest way of fulfilling the condition of Random Selection is to divide the material into a number of units and select a fixed number of them by a purely mechanical process. Often the material itself may be distributed randomly and the lack of randomisation may make very little difference. But the great advantage of Random Selection is that it gives certainty to inferences and also serves to eliminate sources of disturbances which may be unsuspected at the beginning. In addition, the best unbiassed estimate of the quantity in question with its standard error can be made only for Random Samples.

The necessity for an unbiassed estimate of the sampling error arises when we want to determine whether the amount of sampling is adequate or not. This amount depends upon the magnitude of the sampling error and the degree of accuracy expected from the results of sampling. For example, if the estimate should be correct within an error $r\%$ (r is usually between 1 and 5%) and the coefficient of variation of the estimate is v, the number of experiments (n) to be conducted will be given by

$$\frac{v}{\sqrt{n}} = r \quad \text{i.e.} \quad n = \frac{v^2}{r^2}.$$

* Vide F. Yates, *Annals of Eugenics,* Vol. VI, pp. 202-13.

So the number of experiments is directly proportional to the square of the sampling error. Hence if this number is ascertained, economies may be effected if the experiments are too many, and the number may be increased if the error is great. This number also depends upon the relation of the sampling error to the other errors affecting the results, and hence the experiments should be so planned as to enable these other errors also to be determined. For this purpose, two or more sampling units must be obtained from each batch of material and this selection should be again on a purely random basis.

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APPENDIX B.

CROP-CUTTING EXPERIMENTS IN INDIA

The credit for initiating the crop-cutting experiments in India on a scientific basis goes to Mr. (now H.E. Sir) J. A. Hubback, who devised a system of crop-cutting experiments on a random sampling basis for estimating the rice yield in Bihar and Orissa in 1925. After the starting of the Imperial Council of Agricultural Research, Rao Bahadur M. Vaidyanathan, Statistician to the Council, has been assisting in the work of designing experiments on the sampling basis. More recently the Governments of Madras and the United Provinces also decided to revise their figures of normal yield on the basis of results obtained by a number of experiments carried out on a random sampling basis. Though all the three provinces adopted the random sampling method as basis for selection of fields and plots, there are differences in the procedure followed in the selection of fields and the mode of experiments. So it is proposed to give a short account of the method followed in each province.

1. BIHAR AND ORISSA

A systematic effort to fix standard yield of crops with the help of a large number of crop-cutting experiments was made by Sir John Hubback in 1925, in Santal Parganas and Orissa. An officer was employed in each of the eight sub-divisions averaging nearly 1,000 square miles in extent, and in each about 15 centres were taken, so as to cover as widely as possible the sub-divisional area. The officer in charge of each of the sub-divisions had to spend four days at each centre. In order to make the sampling as regular as possible in time and place, the region round each centre within a radius of 2 miles from the centre was divided into four quadrants. On the first day he had to travel north for 2 miles and return to the centre along north-eastern direction. The remaining three quadrants were similarly traversed in the succeeding three days. He was instructed to take one sample from each field in which harvesting was going on. The limitation of the distance traversed to 2 miles secured that the number of samples obtained would be few in tracts where harvesting was sporadic and many in tracts where it was in full swing, thus correcting any tendency to over-emphasize the yields from relatively unimportant types. At first the officers were asked to take 4 samples from each field. Later it was found that in a great majority of cases they did not differ among themselves enough to affect the mean or standard deviation of the whole set of samples. Hence in subsequent experiments only one sample was taken from each field.

Method of taking the samples.—To take the samples, a particular kind of apparatus was constructed. "The apparatus consists of a small solid block of wood, on which are fixed 4 pairs of guides defining 2 lines at an angle of 60 degrees to one another. Along these lines through the guides are pushed 2 narrow wooden battens, which pass among the stalks of the paddy. Each bears a stop, so that, when this rests against the first pair of guides the length from the point where the battens cross to the slots near the

ends of the batten is 67¼ inches. From one of these slots a third batten is pushed through the stalks to the slot on the other batten, and when this third batten is fixed in the slots, an equilateral triangle is formed comprising an area of 1/3,200 of an acre. The paddy stalks just outside the battens are bent back, and the crop inside cut and threshed out there and then. The grain is placed in a numbered bag and dried for three or four days and then weighed . . . The sampler is instructed to go to the centre of the *ail* (field boundary) roughly parallel to the line on which the harvest is proceeding and take three paces into the field before laying down the solid block of wood which guides the battens". Thus the different samples had to be collected.

2. UNITED PROVINCES

The system recently adopted in the United Provinces may be summarised as follows:—

A revenue district is divided into several homogeneous regions on the basis of the condition of soil, nature of irrigation, etc. For fixing the standard yield of a crop in each region one standard plot and twenty subsidiary plots each of an area 1/20 of an acre are selected on a random basis. All these 20 subsidiary plots are selected round about the standard plot within a radius of 2 or 3 miles. From the standard plot a definite number of cuts over known small areas scattered at random are effected; the total yield thus cut out gives the standard composite sheaf. A composite sheaf for each of the subsidiary plots is obtained in the same manner as the standard sheaf. Thus in addition to the standard sheaf, twenty subsidiary sheafs are also obtained to estimate the standard yield of the crop in the region. The conditions under which the crop has been placed should be definitely specified, e.g. (1) soil conditions, (2) irrigated or unirrigated, (3) caste of the cultivator, (4) preceding crops, and (5) manure if applied within two years.

Selection of standard plot and subsidiary plots.—The Kanungo or other party whose opinion is reliable should make a preliminary round of the fields carrying the crop under test (e.g. wheat, sugar-cane, etc.) and note the fields in which the crop is in their opinion of standard quality. One of these fields should be selected by a mechanical device—say putting the numbers corresponding to these fields in a receptacle and drawing one at random. This field represents the standard field. In this field a rectangular plot (66′ × 33′), i.e., of an area of 1/20 of an acre should be selected. In order to make the selection unbiassed, definite instructions are issued for the selection. It is suggested that the 33' side should be eight paces from the southern or approximately southern boundary of the field along the east to west direction. If it is found that the field in roughly the north and south direction is too narrow to allow of 66' x 33' plot being cut with sufficient margin from the boundaries, the south line of the field can be replaced by the east side, the procedure being the same as regards the position of plot along the north and south directions.

As regards the selection of the 20 subsidiary plots, information should be obtained from the patwaris regarding the survey numbers of fields under the particular crop in the region and from all these numbers 20 should be chosen by the same mechanical device as the standard plot.

The Standard and Subsidiary Sheaves.—It has already been pointed out that the yield of a number of cuttings from the standard and subsidiary plots gives the standard and subsidiary sheaves. These small areas in the standard and subsidiary plots are chosen on a random sampling basis. If the crop is sown broadcast, the sheaves are obtained by the hoop method, and if they are sown in regular lines, by the rod method.

Hoop Method.—The hoop is made up of an iron rod, the internal diameter being 3' 6¾" and area enclosed being 10 sq. ft. It is placed at 22 places chosen at random in the plot. Thus the total area covered is 22 x 10 sq. ft. or 1/128 of an acre. To avoid bias in the selection of plots for placing the hoop, definite places are chosen starting from some fixed points and going in a particular direction, any two consecutive points of a line being equidistant.

Rod Method.—The rod consists of a lath of fixed length with an off-set at an end, the length of the rod being 6' 7¼" and length of off-set 1½". This can be made of 1" planking 2" wide, the off-set being screwed to the main plank and supported by a metal strop. The field can be divided into a number of parallel rows the distance between any 2 consecutive rows being equal to the length of off-set. From each of these rows one rod length of crop may be cut from each row. The total from all rows comprises the sheaf.

The balance of crop remaining in the standard plot can be cut and the yield can be noted. This is termed the residue of the standard plot. If this is added to the yield of the sheaf, the total yield of the standard plot can be obtained.

Yield per acre of the subsidiary plots.

1. *Hoop method*—

Yield per acre = Weight of average of sample sheaves (of 22 hoop throws) × 198.

2. *Rod Method*—

Yield per acre = Weight of the average of sample sheaves (from cuts 1/10 of line, each length) ×200.

Yield per acre is also calculated by

$$\frac{\text{Standard 1/20 acre plot} \times \text{average of all the sheaves}}{\text{Weight of standard sheaf}} \times 20$$

3. MADRAS

In Madras the work of conducting and supervising the experiments is divided between the Revenue and Agricultural Departments; the Revenue Inspectors of the former and the Demonstrators of the latter doing the work under the supervision of the Tahsildars and Deputy Directors respectively. The results are consolidated by the Deputy Directors who send the final report to the Director of Agriculture with their remarks.

The region for fixing the standard yields by the crop-cutting experiments comprises a revenue district and the unit of selection is a village. If the crop under consideration is a major crop like rice which is grown in almost all the villages in the district, the sample is taken from all the villages of the district. But if it is confined to only a few taluks of some districts, like sugar-

cane, etc., a preliminary list of the villages growing that particular crop is prepared with the help of the village registers and the sample of villages is taken from this group.

Sampling of Villages.

For each district, the total number of villages (N) should first be divided by the number of villages to be sampled, and the nearest integer to the quotient gives the sampling factor K. The villages of the district, forming the general population from which the sample has been taken, should be arranged serially and the 1st, (K + 1)th, (2K + 1)th, etc. villages of the series should form the sample. The villages can be sampled in the collector's office from the record of the village numbers available there.

Sampling of Fields.

In the list of selected villages, every field bearing some survey number, say 25, should be marked out for experiments on a particular crop, different numbers being chosen for different crops. If the crop is not grown in the field so marked out, the nearest field growing the crop should be selected and if the crop is not grown in the village, the nearest village growing the crop should be selected, the field being chosen as detailed above.

Technique of Experiment.

In each of the fields chosen a plot of one cent (1/100 of an acre) should be marked out, near the centre of the field. It should be in the form of a rectangle (20 links x 50 links). The area should be marked with four pegs at least a month before harvest time and roped all round. The sketch of the field with detailed measurements of the plot so selected should be recorded in a register just prior to harvest, the measurements should be checked to ensure that the pegs have not been displaced from their true position or otherwise meddled with. After harvesting, the crop should be thoroughly dried, thrashed and weighed correct to the nearest ounce. The results of the experiment should be tabulated in the form given below:—

1. District
2. Taluk
3. Village
4. Type of soil
5. Taram and class of soil
6. Survey number of field
7. Assessment of land per acre
8. Crop (irrigated or dry)
9. Name of variety
10. Weight of grain from one cent (to the nearest ounce)
11. Date

APPENDIX B-1.

SAMPLING METHOD FOR FINDING THE AREA UNDER JUTE IN BENGAL (DEVISED BY PROF. P. C. MAHALANOBIS).

Method.

The area to be surveyed should at first be divided into a number of zones which are homogeneous with respect to the intensity of cultivation of the crop (in this case jute). A number of points should be selected at random in each zone, and at each point a sampling unit (called a grid) of suitable size should be fixed. The number of the plots and the area of the grid depend upon the dispersion of the size of the plots under the crop and the degree of accuracy expected from the method. Each grid has to be surveyed in detail and the area under each crop noted carefully. From this, the proportion of the area under jute can be found for each grid. The average proportion for all the grids in a zone gives the proportion of area under jute in that zone. This average proportion multiplied by the total area of the zone gives the estimated area under jute in the zone. The total of the areas in the different zones gives the estimated area in the region under survey.

Application of the Method.

The unit for a sample point can be taken to be a plot, and if all the plots in a zone are of equal area, the required number of plots can be selected by a straightforward mechanical process. But on account of the dispersion of the size of the plots, a mechanical apparatus called co-ordinagraph was devised, by means of which random points could be marked on a cadastral map. There was also some difficulty in fixing the sample grids, because often they did not coincide exactly with the boundaries of the plots included in them. To overcome this difficulty, the 'Half unit method' was adopted by means of which all plots with more than half their area inside the grid were included in it, and those with less than half were excluded. Then the serial (revenue) numbers of the plots included in each grid were noted carefully. The area of each plot and the crop grown on it were carefully recorded, and then tabulated separately to find the total area under each crop in each grid. From these figures the proportion of area under jute in each individual grid was ascertained. The average of the proportions in the different grids gave the proportion under jute in the zone.

APPENDIX C-1.

CROP REPORTING SERVICE OF THE OFFICIAL BUREAU OF AGRICULTURAL STATISTICS, U.S.A.

The following is an extract from the official bulletin:—

"The Bureau of Statistics issues each month detailed reports relating to agricultural conditions throughout the United States, the data upon which they are based being obtained through a special field service, a corps of state statistical agents, and a large body of voluntary correspondents composed of the following classes: County correspondents, township correspondents, individual farmers, and special cotton correspondents.

"The special field service consists of seventeen travelling agents, each assigned to report for a separate group of states. These agents are specially qualified by statistical training and practical knowledge of crops. They systematically travel over the district assigned to them, carefully note the development of each crop, keep in touch with best informed opinion, and render written and telegraphic reports monthly and at such other times as required.

"There are forty-five state statistical agents, each located in a different state. Each reports for his state as a whole, and maintains a corps of correspondents entirely independent of those reporting directly to the Department at Washington. These state statistical correspondents report each month directly to the State agent on schedules furnished to him. The reports are then tabulated and weighted according to the relative product or area of the given crop in each county represented, and are summarized by the State agent, who coordinates and analyses them in the light of his personal knowledge of conditions, and from them prepares his reports to the Department.

"There are approximately 2,800 counties of agricultural importance in the United States. In each the Department has a principal county correspondent who maintains an organization of several assistants. These county correspondents are selected with special reference to their qualifications and constitute an efficient branch of the crop-reporting service. They make the county the geographical unit of their reports, and, after obtaining data each month from their assistants and supplementing these with information obtained from their own observation and knowledge, report directly to the Department at Washington.

"In the townships and voting precincts of the United States in which farming operations are extensively carried on the Department has township correspondents who make the township or precinct the geographical basis of reports, which they also send directly to the Department each month.

"Finally, at the end of the growing season a large number of individual farmers and planters report on the results of their own individual farming operations during the year; valuable data are also secured from 30,000 mills and elevators.

"With regard to cotton, all the information from the foregoing sources is supplemented by that furnished by special cotton correspondents, embrac-

ing a large number of persons intimately concerned in the cotton industry; and, in addition, inquiries in relation to acreage and yield per acre of cotton are addressed to the Bureau of the Census's list of cotton ginners through the courtesy of that Bureau.

"Eleven monthly reports on the principal crops are received yearly from each of the special field agents, county correspondents, State statistical agents, and township correspondents, and one report relating to the acreage and production of general crops annually from individual farmers.

"Six special cotton reports are received during the growing season from the special field agents, from the county correspondents, from the State statistical agents, and from township correspondents, and the first and last of these reports are supplemented by returns from individual farmers, special correspondents, and cotton ginners . . . ."

"The work of making the final crop estimates each month culminates at sessions of the Crop Reporting Board, composed of five members, presided over by the statistician and chief of Bureau as Chairman . . . . . When the Board has assembled, reports and telegrams regarding speculative crops from State and field agents . . . . . are tabulated, and the figures, by States, from the several classes of correspondents and agents relating to all crops dealt with are tabulated in convenient parallel columns; the Board is thus provided with several separate estimates covering each state and each separate crop, made independently by the respective classes of correspondents and agents of the Bureau, each reporting for a territory or geographical unit with which he is thoroughly familiar . . . . . . These results are then compared and discussed by the Board under the supervision of the Chairman, and the final figures for each state are decided upon."

From the above extract, it is seen that each state of the U.S.A. maintains a statistical agent with a group of correspondents under him, and the state agent analyses the data supplied by the several correspondents every month and prepares a memorandum, in the light of the data before him and his personal knowledge of the conditions, which he forwards to the Federal Board. This Board has an independent body of county and township correspondents who are selected with special reference to their qualifications. They obtain information from their assistants and supplementing it with the information obtained from their own observations and knowledge, report directly to the Federal Department. In addition to this there is a special field service consisting of travelling agents who are specially qualified by statistical training and practical knowledge. They keep in touch with the regions assigned to them and send their own reports. Finally at the end of the season, a large number of individual farmers and planters, and the mills and elevators, supply very useful information about the total crop raised during the year. Hence the statistician of the American Bureau of Crop Statistics, will have before him four sets of independent estimates covering each State and each crop, supplied by (1) State agents (2) county and township correspondents (3) special field service (4) non-officials. The results of the analysis of these four estimates are discussed by an expert crop-reporting Board, which decides the final figures adopted for each State.

APPENDIX C-2.

COLLECTION OF AGRICULTURAL STATISTICS IN ENGLAND AND WALES.

Acreage Production and Livestock.

The collection of the Agricultural Statistics of England and Wales relating to the acreage of the various crops and the numbers of livestock is made annually in the month of June by the Ministry of Agriculture and Fisheries.

For the purpose of the collection of the returns, and for ascertaining the annual produce of crops, and monthly reports, skilled reporters to the number of about 300 have been appointed by the Ministry and are paid by fees proportionate to the extent and character of the district allotted to them.

Monthly Agricultural Reports.

Each crop reporter is required to furnish on the last day of each month on the form supplied to him (Form No. 18/SS) a short report, based on his own observations and upon information acquired from farmers throughout his district, on the agricultural conditions and the progress and prospects of the various crops in his district as a whole. These reports include advance estimates of the area under wheat and estimates of the forthcoming yield per acre of the corn, hay and root crops. Crop reporters are also expected in these reports to answer questions on matters of importance at the moment, upon which, with their intimate knowledge of farming in the district, they should be able to reply in general terms without having to make special or exhaustive enquiries.

The information obtained is summarised and embodied in the Monthly Agricultural Report which is published about the 8th of each month.

Annual Returns.

Collection of the Returns.—It is the duty of crop reporters, on the day prior to the date fixed for the collection of the annual returns, usually the 4th June, to send by post to every occupier of more than one acre of land a schedule (398/SS) which is to be filled in by the occupier on the date fixed. and then returned through the post to the crop reporter. Under the Agricultural Returns Act 1925 the return is compulsory.

If the forms are not returned promptly, it is the duty of the crop reporter to send two reminders by post (printed forms 510|SS and 511|SS being supplied for this purpose) and if this is ineffectual to make a personal application and if necessary to forward an estimated return. Crop reporters are asked to forward the names and addresses of those who definitely refuse to make a return or of those who, there is reason to believe, are deliberately withholding their returns. Legal action is taken where desirable.

Each crop reporter is provided with lists (Parish List No. 1) on which he is required to enter the name, name of holding and postal address of the occupiers of the various holdings in his district. He is also required to enter on the Parish List No. 1 from the schedules when received, the total acreage under crops and grass, and of rough grazings respectively of each holding,

and to note whether the schedules were received without or after a reminder, or collected personally and the number of estimates made. Parish Lists No. 2, containing a list of the parishes in his districts are required to be made up by the reporter as soon as the schedules are sent out.

Detailed instructions (516|SS) are furnished to each reporter for his guidance in connection with the collection of the returns.

When the returns for a parish are complete they are arranged in numerical order to agree with the entries on Parish Lists No. 1 and forwarded to the Ministry, each parish being tied up in a separate bundle. At the same time Parish Lists No. 1 are required to be sent by separate letter post, the date of forwarding of the returns and manner of dispatch being noted on the lists. When all the Parish Lists No. 1 have been dispatched the Parish List No. 2 containing the respective dates of dispatch of the No. 1 Lists is forwarded to the Ministry.

The number of the schedules forwarded by the reporters in respect of the holdings of persons occupying more than one acre of agricultural land varies slightly from year to year and was, in 1933, 396,000.

Estimation of Produce.

For this purpose forms are supplied to crop reporters (659|SS for Hops, 652|SS for Corn and Hay and 653|SS for roots and potatoes) giving for each parish in the district assigned to them the acreage of those crops, as ascertained in June by the method described above. They are required to furnish not later than the 15th November estimates of the yield per acre in each parish of wheat, barley, oats, mixed corn, beans, peas and hay (from clover or rotation grasses, and from permanent grass), potatoes, turnips and swedes and mangolds. Similar estimates of the produce of hops are due on the 5th October.

The unit of observation is the parish, for which area a crop reporter is directed, after acquiring all the information he can from farmers, threshing machine owners and others, to estimate the average yield per acre of each crop. The total number of parishes dealt with in England and Wales is about 14,250.

The aggregate results in each parish are obtained by multiplying the area of each crop by the estimated yield for that parish. The parish totals are then summarised into counties and the average yield per acre of each crop in each county is calculated from the totals thus arrived at. The final results for England and Wales are made up by the addition of the total produce from each county.

(Extracted from a Memorandum published by the Ministry of Agriculture and Fisheries of Great Britain).

INTRODUCTORY NOTE TO TABLES.

As Burma was separated from India in 1937, figures for Burma are excluded in all tables, from the beginning of the period. Figures for Tables I, II, X and XI are taken from *Agricultural Statistics, Vol. I.* Figures in Table X are the weighted averages of the corresponding provincial figures given in this volume, the weights being proportional to the area under the crop in the Province. Figures for Tables III and IV are extracted from the volumes *Estimates of Area and Yield of Principal Crops in India.* For years prior to 1920-21, figures for British India are not available separately, as the provincial figures included those of the minor States in those Provinces. For the subsequent years also, the figures of the corresponding minor States are added to those of the respective British Indian Provinces to make the figures of the whole period comparable. The figures for tables XII to XXIII are also taken from the volumes *Estimates of Area and Yield of Principal Crops in India*; but these do not include minor States, and hence they start from 1920-21 only. The figures for Table V are taken from *The Indian Trade Journal* and those for Table VII are taken from *Agricultural and Animal Husbandry in India* published by the Imperial Council of Agricultural Research. For reasons given in the body of the book, figures for earlier years in Tables I to IV are not strictly comparable with those for later years. Even in recent volumes, there are changes due to the introduction of revised figures, and these sometimes cause variations in the figures given in one volume and another. In Tables VIII and IX, Burma is not excluded, but this does not seriously affect the results as we are interested in the relative changes in Agricultural and Industrial Production.

TABLE I.

AREA OF BRITISH INDIA ACCORDING TO PROFESSIONAL SURVEY AND VILLAGE PAPERS.

(In thousands of acres.)

Year	Area according to Professional Survey	Area according to Village Papers	Year	Area according to Professional Survey	Area according to Village Papers
1900-01	444,768	444,879	1918–19	510,195	507,421
–02	448,949	447,737	–20	510,178	507,497
–03	450,037	450,871	1920-21	511,029	508,007
–04	450,215	450,696	–22	511,033	507,840
–05	451,962	452,564	–23	511,454	508,408
1905–06	452,594	453,231	–24	512,094	508,880
–07	469,086	464,917	–25	511,993	508,885
–08	506,469	502,346	1925–26	511,957	508,838
–09	510,131	508,381	–27	512,097	508,964
–10	510,359	507,729	–28	514,385	511,343
1910–11	509,788	506,924	–29	514,394	511,883
–12	509,807	507,322	–30	514,065	511,666
–13	510,212	508,023	1930–31	513,495	511,672
–14	510,713	508,310	–32	513,019	511,207
–15	510,511	508,132	–33	512,195	511,882
1915–16	510,516	507,334	–34	511,483	511,015
–17	510,186	507,057	–35	512,211	511,745
–18	510,142	507,314	1935–36	511,512	511,022

Note.—Tables I to IV exclude Burma.

TABLE II

CLASSIFICATION OF THE AREA IN BRITISH INDIA

(In thousands of acres.)

Year.	Total Area.	Forests.	Not available for Cultivation.	Culturable Waste.	Current Fallows.	Net Area Sown.	Irrigated Area.
1900–01	444,879	55,379	82,123	81,217	40,497	185,663	29,185
–02	447,737	55,183	83,175	83,354	39,743	188,282	31,840
–03	450,871	55,134	83,880	83,626	34,392	193,839	32,263
–04	450,696	55,216	85,376	80,046	33,751	196,306	33,558
–05	452,564	55,156	85,325	80,281	36,637	195,166	30,229
1905–06	453,231	54,953	84,445	80,202	38,347	195,285	34,552
–07	464,917	60,753	85,137	82,636	34,941	201,450	35,921
–08	502,346	63,854	103,166	86,739	50,545	198,042	39,066
–09	508,381	63,756	106,318	87,104	46,817	204,388	41,502
–10	507,729	62,816	106,308	87,655	41,897	209,054	40,524
1910–11	506,924	62,038	104,007	89,058	41,997	209,756	39,896
–12	507,322	61,886	104,272	88,834	49,687	202,646	39,723
–13	508,023	63,141	101,230	89,542	43,942	210,168	44,447
–14	508,310	63,279	101,634	90,616	47,859	204,920	45,764
–15	508,132	63,206	100,685	89,880	41,042	213,319	46,061
1915–16	507,334	65,010	99,752	88,393	46,617	207,562	45,739
–17	507,057	64,716	99,448	87,232	40,581	215,080	46,732
–18	507,314	66,380	97,996	86,378	43,538	213,022	44,638
–19	507,421	66,991	97,614	88,805	67,526	186,486	45,963
–20	507,497	66,317	97,753	88,644	47,148	207,635	47,713
1920–21	508,007	66,357	97,943	90,244	56,185	197,279	47,783
–22	507,840	66,164	97,800	90,061	46,645	207,170	46,475
–23	508,408	66,194	97,192	93,096	43,295	208,630	46,499
–24	508,880	66,225	97,082	93,649	45,693	206,231	43,485
–25	508,885	66,835	96,176	92,502	43,438	209,934	43,849
1925–26	508,838	66,976	95,664	91,749	45,542	208,575	46,139
–27	508,964	66,871	94,681	92,667	45,958	208,455	46,318
–28	511,343	66,692	95,591	95,634	46,951	206,475	41,874
–29	511,883	66,795	95,098	94,920	44,442	210,629	48,253
–30	511,666	66,719	93,119	95,660	45,782	210,386	49,543
1930–31	511,672	66,713	93,818	94,228	45,823	211,092	48,226
–32	511,207	66,365	93,557	95,104	44,797	211,365	47,320
–33	511,882	66,632	93,495	94,783	46,903	210,070	48,453
–34	511,015	66,908	92,947	93,872	43,988	214,007	48,946
–35	511,745	67,029	92,820	94,581	48,498	208,817	49,048
1935–36	511,022	67,333	92,882	93,968	47,131	209,709	49,881

TABLE II (*Contd.*)

CLASSIFICATION OF THE AREA UNDER IRRIGATION.

Irrigated Area according to sources (1000 acres).					Area of Crops Irrigated (1000 acres).							
Year.	Canals.	Tanks.	Wells.	Other sources.	Rice.	Wheat.	Barley.	Sugarcane.	Other food Crops.	Cotton.	Other non-food Crops.	Total.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1900–01	14,544	4,263	9,339	1,039	Included in column (10)	7,493	Included in column (10)	Included in column (10)	13,071	Included in column (12)	4,688	25,253
–02	14,365	4,918	11,363	1,194		8,330			13,946		4,581	26,856
–03	14,532	5,005	11,554	1,172		8,491			13,365		4,776	33,377
–04	15,779	5,667	10,739	1,373		9,441			13,451		4,947	34,709
–05	15,003	4,485	9,477	1,264		7,420			12,041		5,238	31,322
1905–06	16,660	4,708	11,717	1,467		9,133			14,787		5,405	36,337
–07	17,668	3,077	10,938	4,238		9,208			14,780		6,040	37,496
–08	17,341	4,596	14,150	2,979		8,305			27,551		6,699	42,607
–09	18,451	5,839	12,487	4,725		8,591			29,399		6,645	44,673
–10	17,660	5,636	11,871	5,357		8,908			28,799		5,825	43,577
1910–11	17,717	5,963	10,204	6,012		8,791			27,979		6,224	43,059
–12	18,243	5,225	10,398	5,857		8,140			27,739		7,506	43,226
–13	19,565	6,632	12,336	5,914		9,084			31,609		7,339	48,095
–14	19,745	6,170	13,852	5,997		9,705			31,648		8,065	49,455
–15	20,694	6,746	12,540	6,081		10,119			31,431		7,897	49,483
1915–16	20,016	6,702	12,533	6,488		10,056			32,809		6,835	49,735
–17	21,053	6,988	12,012	6,679		10,310			32,423		7,393	50,162
–18	20,653	6,373	11,122	6,490		9,792			30,988		7,949	48,765
–19	20,437	7,113	14,198	4,215		9,562			32,370		7,781	49,749

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TABLE II (*Concluded*).

CLASSIFICATION OF THE AREA UNDER IRRIGATION.

Year.	Canals.	Tanks.	Wells.	Other sources.	Rice.	Wheat.	Barley.	Sugarcane.	Other food Crops.	Cotton.	Other non-food Crops.	Total.
	Irrigated Area according to sources (1000 acres).				Area of Crops irrigated (1000 acres).							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1919–20	22,417	7,175	12,674	5,447	17,487	10,106	3,059	1,868	11,636	2,827	4,687	51,706
1920–21	21,887	7,119	14,221	4,556	17,114	10,248	3,143	1,829	11,800	2,665	4,489	51,322
-22	22,307	6,844	12,107	5,217	16,659	9,754	2,809	1,612	12,070	1,568	5,134	49,642
-23	22,920	6,790	11,423	5,366	16,973	9,852	2,578	1,903	11,818	4,926	4,909	49,892
-24	22,307	5,689	10,740	4,749	15,901	8,551	2,114	1,940	11,021	4,713	4,694	46,670
-25	22,707	5,758	10,550	4,834	15,668	8,790	2,163	1,569	10,778	3,142	4,800	46,945
1925–26	23,443	5,628	11,701	5,367	16,856	9,672	2,558	1,723	10,598	3,376	4,532	49,351
-27	23,741	5,357	11,991	5,229	15,772	9,924	2,590	1,996	10,896	3,156	4,720	49,091
-28	23,038	5,678	9,721	3,437	16,546	7,955	1,288	2,034	9,783	2,461	4,802	44,904
-29	25,228	5,588	12,936	4,501	16,722	10,264	2,565	1,653	12,405	3,514	5,171	52,330
-30	25,819	6,097	12,680	4,947	17,365	10,640	2,959	1,690	12,450	3,206	5,072	53,418
1930–31	24,949	6,587	11,728	4,962	18,100	10,121	2,549	1,921	11,678	2,953	4,928	52,250
-32	24,350	6,221	11,438	5,311	17,246	9,957	2,363	1,989	11,347	2,910	4,971	50,782
-33	25,161	6,285	12,192	4,815	17,711	10,449	2,376	2,200	11,547	2,645	5,287	52,278
-34	25,863	6,344	11,313	5,426	17,778	11,031	2,555	1,918	11,247	3,475	5,062	53,068
-35	25,153	6,031	12,468	5,396	17,031	11,212	2,622	1,987	11,444	3,380	4,986	52,662
1935–36	26,595	5,845	12,706	4,735	17,626	10,913	2,467	2,403	11,440	4,031	5,056	54,036

TABLE III.

AREA UNDER CERTAIN IMPORTANT CROPS IN BRITISH INDIA (INCLUDING MINOR STATES)

(In thousands of acres.)

Year.	Rice.	Wheat.	Barley.	Jowar.	Bajra.	Maize.	Gram.	Sugar Cane.
1900–01	42,605	21,269	..	..	..	..	..	2,404
–02	41,953	20,839	..	..	..	..	..	2,316
–03	45,288	20,775	..	..	..	..	..	2,208
–04	42,700	24,192	..	..	..	..	..	2,115
–05	44,678	24,087	..	..	..	..	..	2,245
1905–06	47,715	22,903	..	..	..	..	..	2,111
–07	47,183	24,878	..	..	..	..	..	2,352
–08	47,506	19,678	..	..	..	..	..	2,639
–09	45,599	22,202	..	..	..	..	..	2,203
–10	53,417	23,608	..	..	..	..	..	2,157
1910–11	53,629	25,811	..	..	..	..	..	2,162
–12	57,849	26,641	..	..	..	..	..	2,383
–13	61,871	24,988	..	..	..	..	..	2,425
–14	65,369	24,453	7,144	20,618	14,756	5,976	8,909	2,546
–15	66,632	27,575	7,821	20,536	15,702	5,986	13,730	2,311
1915–16	67,759	25,673	7,924	22,356	14,283	6,524	13,160	2,391
–17	69,510	26,927	7,883	21,184	15,165	6,359	15,239	2,416
–18	69,634	28,431	8,427	20,475	12,729	6,288	16,277	2,809
–19	66,486	20,208	6,395	20,031	11,205	5,888	7,318	2,857
–20	67,956	25,120	7,419	21,815	14,552	6,462	12,559	2,647
1920–21	67,732	21,795	6,203	21,962	11,991	5,993	9,143	2,543
–22	69,007	24,090	7,303	23,340	15,888	6,079	14,623	2,361
–23	69,673	26,132	7,350	21,933	13,939	5,722	16,233	2,699
–24	65,409	26,003	7,126	20,348	13,674	5,658	14,330	2,883
–25	67,754	26,467	6,898	21,652	11,964	5,121	16,383	2,498
1925–26	68,421	25,495	6,573	19,840	12,257	5,240	14,182	2,646
–27	65,815	25,926	6,311	22,682	15,503	5,325	14,383	2,888
–28	64,273	26,448	6,772	22,691	15,040	5,726	13,682	2,916
–29	68,412	26,803	7,483	22,261	14,463	5,787	13,441	2,535
–30	66,199	26,631	7,001	24,919	14,477	6,330	11,267	2,441
1930–31	68,023	26,624	6,609	24,292	14,701	6,230	13,393	2,728
–32	69,682	27,172	6,384	23,140	15,476	5,871	15,669	2,898
–33	67,947	26,866	6,322	22,832	15,459	6,023	13,744	3,232
–34	68,012	29,630	6,614	22,090	13,382	5,816	16,312	3,221
1934–35	67,615	27,670	6,495	23,302	14,309	5,924	13,472	3,383
1935–36	68,959	27,006	6,089	22,640	13,684	5,936	14,508	3,990
–37	70,228	27,210	6,448	26,656	13,314	5,731	15,549	4,320
–38	70,389	28,747	6,632	23,831	14,012	5,623	13,682	3,728

TABLE III—(Concluded)

AREA UNDER CROPS IN BRITISH INDIA

Year.	Linseed (including mixed crops).	Rapeseed.	Sesamum.	Groundnut.	Cotton.	Jute.	Tea.	Coffee.	Rubber.
1900–01	2,512	5,509	4,282	294	11,479	2,093	..	..	..
–02	2,675	4,532	3,946	434	11,876	2,264	..	..	..
–03	2,834	5,744	4,681	491	13,026	2,143	..	..	..
–04	3,672	5,997	4,983	474	13,962	2,275	..	..	..
–05	3,618	6,136	3,999	460	15,612	2,900	..	..	..
1905–06	2,674	6,014	4,148	486	17,006	3,128	501	..	..
–07	3,079	6,382	4,143	622	17,168	3,483	503	..	..
–08	1,615	5,191	4,406	732	16,820	3,942	510	..	..
–09	2,442	6,016	4,476	852	15,461	2,835	519	..	..
–10	2,639	6,623	5,073	902	15,793	2,857	532	..	..
1910–11	3,111	6,307	4,770	853	17,396	2,929	532	..	..
–12	4,435	7,008	4,144	1,075	15,566	3,086	541	..	..
–13	3,613	5,948	4,341	1,167	16,260	2,933	555	..	..
–14	2,618	6,260	4,464	1,058	19,091	2,872	570	..	..
–15	3,091	6,500	4,966	2,144	18,671	3,315	583	..	..
1915–16	3,045	6,431	4,462	1,411	13,260	2,348	591	..	..
–17	3,244	6,489	4,454	2,069	16,443	2,671	604	..	..
–18	3,756	6,916	3,690	1,687	18,680	2,700	620	..	..
–19	1,754	4,856	3,005	1,158	15,837	2,470	631	..	..
–20	3,030	5,843	3,574	1,306	16,958	2,800	645	58	23
1920–21	1,962	4,983	3,779	1,824	16,150	2,473	652	57	19
–22	2,728	6,293	5,063	1,682	13,187	1,505	655	58	17
–23	3,132	6,205	3,304	2,301	15,325	1,788	655	59	13
–24	3,402	6,105	3,605	2,207	17,218	2,753	657	65	14
–25	3,307	6,376	3,559	2,289	19,790	2,738	650	67	14
1925–26	3,313	5,464	3,345	3,474	20,866	3,084	672	70	15
–27	3,073	5,464	3,146	3,493	17,621	3,804	679	72	17
–28	2,933	5,794	3,757	4,401	17,421	3,341	690	73	18
–29	2,730	6,897	3,702	5,102	19,007	3,109	705	75	17
–30	2,503	5,834	3,432	4,558	18,356	3,381	711	75	18
1930–31	2,674	6,511	3,582	5,323	16,361	3,458	722	75	19
–32	2,908	6,149	3,698	4,306	16,452	1,845	722	80	16
–33	2,937	6,024	3,814	5,488	15,345	2,119	721	79	14
–34	2,821	5,930	3,917	5,948	16,389	2,491	726	80	13
–35	2,919	5,286	3,166	4,016	16,709	2,644	733	81	14
1935–36	2,892	5,188	3,369	3,900	17,874	2,162	733	82	16
–37	3,070	5,811	3,419	5,511	18,061	2,855	752	83	17
–38	3,196	5,397	3,739	7,109	18,650	2,847	752	..	17

TABLE IV

YIELD OF CERTAIN IMPORTANT CROPS IN BRITISH INDIA (INCLUDING MINOR STATES)

Year.	Food Crops (1000 tons)							
	Rice.	Wheat.	Barley.	Jowar.	Bajra.	Maize.	Gram.	Sugar Cane.
1900–01	18,027	6,691	..	..	..	..	..	2,277
–02	16,185	5,694	..	..	..	..	..	2,022
–03	20,823	7,317	..	..	..	..	..	1,907
–04	18,744	8,719	..	..	..	..	..	1,872
–05	19,386	6,830	..	..	..	..	..	2,169
1905–06	18,760	7,971	..	..	..	..	..	1,726
–07	18,291	7,587	..	..	..	..	..	2,205
–08	15,860	5,655	..	..	..	..	..	2,047
–09	16,355	6,971	..	..	..	..	..	1,873
–10	25,304	8,785	..	..	..	..	..	2,215
1910–11	25,943	9,117	..	..	..	..	..	2,310
–12	25,221	8,991	..	..	..	..	..	2,451
–13	23,982	8,521	..	..	..	..	..	2,555
–14	24,782	7,705	2,685	3,943	1,986	2,016	1,937	2,292
–15	23,606	7,187	3,065	5,104	2,612	2,031	3,841	2,462
1915–16	28,530	7,816	3,169	5,983	2,389	2,433	3,428	2,634
–17	30,257	8,947	3,336	5,034	2,902	2,310	4,234	2,731
–18	30,988	8,870	3,334	4,411	2,139	2,379	4,446	3,387
–19	20,169	6,829	2,782	3,351	1,387	1,748	1,920	2,424
–20	28,055	9,194	3,205	5,561	2,842	2,558	3,685	3,001
1920–21	23,379	6,020	2,509	3,630	1,969	2,052	2,362	2,492
–22	28,053	8,976	3,128	5,580	2,640	2,418	4,338	2,582
–23	28,682	8,887	3,117	4,981	2,420	1,878	5,173	3,009
–24	23,666	8,542	2,937	4,732	2,393	2,153	4,442	3,285
–25	25,537	7,716	2,644	5,488	2,614	1,650	4,162	2,519
1925–26	25,364	7,686	2,584	4,584	2,274	1,837	3,849	2,949
–27	24,147	8,027	2,551	4,958	2,845	1,882	3,940	3,228
–28	22,767	7,008	2,094	5,515	2,641	2,218	3,179	3,181
–29	26,589	7,756	2,520	5,293	2,536	1,962	2,587	2,672
–30	25,752	9,530	2,293	5,591	2,284	2,409	2,975	2,677
1930–31	26,604	8,235	2,392	5,493	2,583	2,362	3,315	3,141
–32	28,139	7,841	2,388	5,027	2,670	2,229	3,694	3,875
–33	25,603	8,240	2,351	5,052	2,584	2,110	3,343	4,559
–34	25,062	8,112	2,411	4,888	2,119	1,869	3,665	4,776
–35	25,098	8,333	2,512	5,134	2,412	2,132	3,354	4,997
1935–36	22,599	8,132	2,325	4,953	2,536	2,118	3,553	5,743
–37	27,143	8,513	2,311	5,401	2,299	1,836	3,817	6,289
–38	26,102	9,380	2,087	4,991	2,418	2,013	3,243	5,163

TABLE IV. (Concluded).

YIELD OF CERTAIN IMPORTANT CROPS IN BRITISH INDIA

Year.	Oilseeds. (1000 tons.)				1000 bales.			1000 lbs.	
	Linseed.	Rapeseed.	Sesamum.	Groundnut.	Cotton.	Jute.	Tea. (Millions of lbs.)	Coffee.	Rubber.
1900–01	317	1,022	438	29	2,475	6,526	..	..	..
–02	333	956	335	63	2,272	7,438	..	..	..
–03	459	1,038	540	62	2,786	6,577	..	..	..
–04	546	1,125	576	94	2,608	7,191	..	..	..
–05	314	876	306	215	3,095	7,364	..	..	..
1905–06	328	962	375	211	2,882	8,088	211	..	..
–07	396	1,053	514	274	4,016	9,127	230	..	..
–08	150	688	265	285	2,648	9,736	231	..	..
–09	281	987	445	376	3,117	6,271	234	..	..
–10	409	1,270	561	394	3,910	7,173	245	..	..
1910–11	541	1,250	499	461	3,177	7,913	249	..	..
–12	618	1,330	367	554	2,516	8,193	254	..	..
–13	525	1,241	442	581	3,529	9,718	282	..	..
–14	369	1,088	378	661	4,196	10,309	292	..	..
–15	388	1,219	524	859	4,065	7,273	297	..	..
1915–16	464	1,102	460	942	2,852	8,241	352	..	..
–17	510	1,191	482	1,085	3,326	8,772	352	..	..
–18	496	1,153	363	952	3,127	6,912	352	..	..
–19	209	760	235	527	2,900	8,412	358	..	..
–20	412	1,142	225	720	4,497	5,857	353	11,583	1,885
1920–21	266	854	365	907	2,837	3,974	322	12,137	1,872
–22	425	1,164	476	855	3,202	5,356	254	10,626	521
–23	514	1,205	391	1,110	3,441	8,330	289	15,219	1,344
–24	441	1,146	369	957	3,628	7,983	348	8,807	1,738
–25	369	1,216	404	1,309	4,419	8,810	348	18,157	2,197
1925–26	384	908	338	1,813	4,414	12,015	335	9,396	2,530
–27	391	992	359	1,628	3,513	10,129	364	17,517	2,975
–28	330	816	462	2,226	4,350	9,831	362	19,122	3,004
–29	309	903	418	2,534	4,257	10,258	374	12,534	3,377
–30	361	1,083	369	2,035	4,226	11,122	402	22,737	3,209
1930–31	352	981	415	2,427	3,948	5,522	363	15,888	2,396
–32	383	1,016	422	1,938	3,052	7,026	365	17,236	753
–33	379	1,035	451	2,526	3,638	7,941	401	15,769	32
–34	343	939	448	2,736	4,066	8,426	353	17,891	397
–35	378	877	330	1,489	3,489	7,162	369	16,475	1,228
1935–36	340	943	375	1,770	4,740	8,630	365	23,355	2,388
–37	361	952	385	2,362	5,150	9,611	364	18,492	3,697
–38	395	1,009	397	2,923	4,609	8,656	395	..	4,224

TABLE V

AREAS UNDER RICE, COTTON AND GROUNDNUT ACCORDING TO THE DIFFERENT FORECASTS IN THE SAME YEAR.

	1000 acres.		
	1st Forecast	2nd Forecast	Final Forecast.
		Rice.	
1933–34	74,994	79,039	81,977
34–35	75,261	78,486	81,026
35–36	74,082	78,161	81,254
36–37	77,786	70,865	72,519
37–38	71,992	69,131	72,554
38–39	65,812	69,837	72,574
		Cotton.	
1933–34	14,031	19,641	22,714
34–35	12,985	20,365	22,600
35–36	14,494	22,118	24,130
36–37	15,769	20,989	24,708
37–38	25,583	25,583	25,583
38–39	15,763	21,492	23,483
		Groundnut.	
1933–34	2,080	5,670	8,115
34–35	2,049	5,094	5,760
35–36	1,859	4,748	5,752
36–37	2,264	6,482	6,663
37–38	2,313	7,014	8,898
38–39	2,593	6,879	8,500

TABLE VI

STATEMENT COMPARING THE APPROXIMATE COMMERCIAL CROP WITH THE CROP FORECASTED IN THE ALL-INDIA COTTON FORECASTS FOR DIFFERENT YEARS ACCORDING TO MAJOR TRADE BLOCKS

(In 1000 bales.)

Major Trade Block.	1932-33			1933-34			1934-35			1935-36		
	Approximate Crop.	Forecasted Crop.	Error.	Approximate Crop.	Forecasted Crop.	Error.	Approximate Crop.	Forecasted Crop.	Error.	Approximate Crop.	Forecasted Crop.	Error.
Assam ..	19	15	— 4	17	15	— 2	27	14	— 13	36	14	— 22
Bengal ..	50	24	— 26	28	24	— 4	30	24	— 6	40	24	— 16
Bihar and Orissa ..		13	—	1	8	+ 7	2	8	+ 6	4	7	+ 3
U. P. ..	122	170	+ 48	176	184	+ 8	186	194	+ 8	208	195	— 13
Punjab ..	887	656	—231	1448	1115	—333	1382	1245	—137	1796	1600	—196
Sind and Br. Baluchistan ..	209	111	— 98	326	163	—163	448	285	—163	517	343	—174
C. P. and Berar ..	865	740	—125	859	724	—135	684	611	— 73	642	646	+ 4
Bombay ..	1525	1490	— 35	1437	1331	—106	1245	1169	— 76	1757	1518	—239
Madras ..	454	412	— 42	542	442	—100	537	455	— 82	642	541	—101
Indian States :												
Rajaputana ..	148	68	— 80	194	78	—116	137	70	— 67	235	91	—144
Central India ..	131	211	+ 80	204	216	+ 12	211	189	— 22	437	304	—133
Nizam's territory ..	285	534	+249	285	564	+279	271	443	+172	368	569	+201
Mysore ..	34	10	— 24	25	8	— 17	20	8	— 12	20	11	— 9

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TABLE VII.

AREAS UNDER NEW AND IMPROVED VARIETIES OF CROPS IN INDIA.

(In 1,000 acres).

Name of Province.	1920-21.	1921-22.	1922-23.	1923-24.	1924-25.	1925-26.	1926-27.	1927-28.	1928-29.	1929-30.	1930-31.	1931-32.	1932-33.	1933-34.	1934-35.	1935-36.
Madras	78	433	360	481	632	592	601	482	824	547	709	906	1,080	1,308	1,550	1,944
Bombay	23	192	881	1,065	1,091	1,489	1,575	1,381	1,517	153*	179*	1,466	1,545	1,323	1,204	971
Bengal	104	159	415	415	445	498	690	1,057	1,998	1,447	1,383	1,282	1,059	1,728	1,846	2,101
U. P.	605	382	496	231	913	1,093	1,455	1,624	2,100	2,538	2,977	3,668	4,048	4,447	4,957	5,745
Punjab	1,115	1,138	1,407	1,680	2,327	2,381	2,852	3,018	3,707	3,987	4,002	4,147	4,045	4,619	5,066	5,779
Burma	90	81	141	184	226	254	390	491	512	534	613	683	882	1,079	1,317	1,427
B .& O.	2	8	10	18	40	51	17	29	74	117	144	265	306	389	470	565
C. P.	488	391	446	791	872	845	871	993	1,305	1,504	1,627	1,491	1,603	1,694	1,843	2,047
Assam	2	6	12	6	5	15	27	23	25	99	102	86	105	79	42	79
N. W. F. P.	..	150	200	205	208	218	317	352	356	372	280	..	..	5	33	18
Total	2,507	2,940	4,368	5,076	6,759	7,436	8,795	9,450	12,418	11,298	12,016	13,994	14,673	16,842	18,671	21,446

* Sind only.

TABLE VIII.

AGRICULTURAL PRODUCTION (QUANTITY AND VALUES)

(Average of two years)

Commodity.	Average Price per Unit in base period (1920-21 and 1921-22).	1920-21 and 1921-22.	1922-23 and 1923-24.		1924-25 and 1925-26.		1926-27 and 1927-28.		1928-29 and 1929-30.		1930-31 and 1931-32.		1932-33 and 1933-34.		1934-35 and 1935-36.	
		Quantity.	Quantity.	Value. (Crores of Rs.)	Quantity.	Value. (Crores of Rs.)	Quantity.	Value. (Crores of Rs.)	Quantity.	Value. (Crores of Rs.)	Quantity.	Value. (Crores of Rs.)	Quantity.	Value. (Crores of Rs.)	Quantity.	Value. (Crores of Rs.)
Rice (million tons)	.. Rs. 9–0–0 per cwt.	30·4	31	558	30·9	556	29·0	504	31·5	567	32·6	587	31·0	558	29·0	504
Wheat (million tons)	.. Rs. 9–1–0 per cwt.	8·3	9·9	179	8·8	159	8·4	152	9·5	172	9·2	167	9·4	170	9·6	174
Sugar-cane (million tons)	.. Rs. 55–0–0 per 500 lbs.	2·6	3·2	79	2·8	69	3·3	81	2·7	67	3·6	89	4·7	118	5·5	138
Tea (million lbs.)	.. Rs. 0–9–3 per lb.	310·0	343·0	20	369·0	21	392·0	23	418·0	25	393·0	23	409·0	24	398·0	23
Cotton (million bales)	.. Rs. 50–9–0 per cwt.	4·0	5·2	94	6·2	112	5·5	100	5·5	100	4·6	83	4·9	89	5·4	100
Jute (million bales)	.. Rs. 300–6–0 per ton.	4·9	8·3	45	10·5	57	10·1	55	10·7	58	5·7	31	8·3	45	8·0	43
Linseed (thousand tons)	.. Rs. 12–6–0 per cwt.	353·0	568·0	14	551·0	14	377·0	9	351·0	8	394·0	10	391·0	10	402·0	10
Rapseed (thousand tons)	.. Rs. 11–6–0 per cwt.	1054·0	1179·0	28	1065·0	26	922·0	22	1002·0	23	1014·0	24	993·0	23	927·0	22
Sesamum (thousand tons)	.. Rs. 15–4–0 per cwt.	450·0	463·0	14	467·0	14	479·0	14	430·0	13	495·0	15	546·0	17	433·0	13
Groundnuts : nuts in shell (millions of tons)	.. Rs. 13–4–0 per cwt.	990·0	1·2	24	1·8	36	2·4	48	2·9	58	2·9	58	3·2	63	2·1	63
Jowar (million tons)	.. Rs. 6–0–0 per maund.	6·5	5·8	95	5·6	91	5·9	96	6·3	103	6·6	108	6·3	103	6·2	103
Bajra (million tons)	.. Rs. 6–5–0 per maund.	2·3	2·3	41	2·1	37	2·5	44	2·0	36	2·7	48	2·3	41	2·6	45
Maize (million tons)	.. Rs. 5–0–0 per maund.	2·3	2·1	29	1·8	25	2·1	29	2·2	30	2·4	33	2·0	28	2·3	31
Gram (million tons)	.. Rs. 7–0–0 per maund.	4·3	4·9	94	4·1	78	3·6	69	2·9	58	3·6	69	3·6	69	3·8	71
Barley (million tons)	.. Rs. 10–4–0 per cwt.	2·8	3·0	62	2·6	54	2·4	50	2·4	48	2·4	48	2·4	50	2·4	50

TABLE VIII (*Contd.*).

AGRICULTURAL PRODUCTION (INDEX NUMBERS)

Base: Average of 1920-21 and 1921-22=100

Commodity.	Average of 1922-23 and 1923-24		Average of 1924-25 and 1925-26		Average of 1926-27 and 1927-28		Average of 1928-29 and 1929-30		Average of 1930-31 and 1931-32		Average of 1932-33 and 1933-34		Average of 1934-35 and 1935-36.	
	Index	Weight	Index	Weight	Index	Weight	Index	Weight	Index	Weight	Index	Weight	Index	Weight
Rice ..	102	40	101	41	95	37	103	42	107	42	102	40	95	36
Wheat ..	121	13	107	12	102	12	116	13	112	12	115	12	117	13
Sugar-cane ..	128	6	112	5	132	6	108	5	142	6	188	8	220	10
Tea ..	111	1	119	1	127	2	135	2	127	2	132	2	128	2
Cotton ..	130	7	155	8	138	8	137	7	115	6	121	6	133	7
Jute ..	177	3	223	4	215	4	228	4	121	2	163	3	157	3
Linseed ..	161	1	153	1	107	1	99	1	115	1	111	1	114	1
Rapeseed ..	117	2	105	2	91	2	99	2	100	2	98	2	92	2
Sesamum ..	103	1	104	1	106	1	96	1	110	1	121	1	96	1
Groundnut ..	120	2	180	3	240	4	290	4	290	4	315	5	205	5
Jowar ..	89	7	86	7	91	7	97	8	102	8	97	7	96	7
Bajra ..	100	3	91	3	109	3	87	3	117	4	100	3	113	3
Maize ..	91	2	78	2	91	2	96	2	102	2	87	2	100	2
Gram ..	111	7	93	6	82	5	66	3	82	5	82	5	86	5
Barley ..	107	5	92	4	86	4	86	3	86	3	86	3	86	3
Composite Index Numbers.														
Weighted Arithmetic Mean ..	111		112		113		111		116		123		121	
Aggregative type ..	109		107		106		102		112		112		111	
Chained Index ..	111		109		107		112		118		120		119	

TABLE IX.

INDUSTRIAL PRODUCTION (Average of two years)

Commodity.	Average price in base period. 1920-21 and 1921-22.	1920-21 and 1921-22	1922-23 and 1923-24		1924-25 and 1925-26		1926-27 and 1927-28		1928-29 and 1929-30		1930-31 and 1931-32		1932-33 and 1933-34		1934-35 and 1935-36.	
		Quantity	Quantity	Value (Crores of Rs.)	Quantity	Value (Crores of Rs.)	Quantity	Value (Crores of Rs.)	Quantity	Value (Crores of Rs.)	Quantity	Value (Crores of Rs.)	Quantity	Value (Crores of Rs.)	Quantity	Value (Crores of Rs.)
*Cotton yarn (millions of lbs.)	Re. 1-2-0 per lb.	677	661·5	74·55	790·3	88·91	808	90·9	741	83·36	916·5	103·11	961	108·1	1030	128·8
Cotton cloth (millions of yards) ..	Rs. 0·4 per yard	165·6	1713·5	68·54	1962·0	78·48	2324	92·96	2116·5	84·66	2651·5	106·06	3058	122·3	3483	139·3
Jute bags (millions) ..	Rs. 0·46 per bag	438·3	365·5	16·81	419·4	19·29	437	20·06	480·4	22·10	478·2	22·00	590	27·1	637	29·3
Jute cloth (millions of yds.)..	Rs. 0·2 per yard	1314	1187·5	23·75	1402·5	28·05	1482	29·64	1560·5	31·21	1461	29·22	1075	21·5	1239	24·8
Sugar (thousands of tons.) ..	Rs. 470 per ton	74·3	84·4	3·97	79·4	3·74	120·4	5·62	105·0	4·94	189·9	8·93	246	11·6	784	36·8
Coal (millions of tons) ..	Rs. 9 per ton	186·5	19·4	17·46	21·1	18·99	21·7	19·53	23·0	20·70	22·8	20·52	18·1	16·3	20·8	18·7
Cement (thousands of tons)...	Rs. 53 per ton	112	193·0	1·03	321	1·71	512	2·71	555	2·95	555	2·95	618	3·3	835	4·4
Paper (thousands of tons.) ..	Rs. 464 per ton	29	25·0	1·16	27·1	1·26	33·0	1·53	39·1	1·82	39·1	1·82	41·1	1·9	46·4	2·2
Pig Iron (thousands of tons.)..	Rs. 34·5 per ton	339·6	454·9	1·57	876·3	3·02	1021·3	3·52	1116·5	3·85	1085·5	3·75	995	3·4	1442	5·0
Steel (thousands of tons.) ..	Rs. 180 per ton	119·2	131·3	2·36	284·0	5·11	394·5	7·11	344·0	6·19	442·0	7·96	551	9·9	652	11·7

*As we are here comparing the growth of industrial activity at different periods, the question of double counting does not arise.

TABLE IX (*Contd.*).

INDUSTRIAL PRODUCTION : INDEX NUMBERS

Base : Average of 1920-21 and 1921-22=100

Commodity.	1922-23 and 1923-24		1924-25 and 1925-26		1926-27 and 1927-28		1928-29 and 1929-30		1930-31 and 1931-32		1932-33 and 1933-34.		1934-35 and 1935-36.	
	Index No.	Weight	Index No.	Weight	Index No.	Weight	Index No.	Weight	Index No.	Weight	Index No.	Weight	Index No.	Weight
Cotton yarn ..	97·5	35	103·5	36	119·5	33	109·5	32	136	34	142	33	152	32
„ cloth ..	103·5	32	118·5	31	140·5	34	128·0	32·5	161	35	185	38	210	35
Jute bags ..	83	8	96	8	100	7	110·0	8	109	7	134	8	145	7
„ cloth ..	89	11	107	11	112·5	11	118·5	12	112	9	82	7	94	6
Coal ..	104	8	113	8	116	7	126	8	122	7	97	5	111	5
Sugar ..	114	2	107	1·5	162	2	141	2	256	3	332	3·5	1055	9
Steel ..	110·5	1	238	2·0	331·5	3	289	2	320	2·5	462	3	547	3
Pig Iron ..	129·5	1	258	1·0	301	1	329	1·5	371	1	293	1	425	1
Cement ..	172·5	1	286·5	1·0	457·5	1	495·5	1	504	1	552	1	746	1
Paper ..	86	1	93·5	0·5	114·0	1	134·5	1	138	0·5	142	0·5	160	1
Composite Index Number.														
Weighted Arithmetic Mean ..	99		106		120		114		140		151		195	
Aggregative type Mean ..	99		115		137		130		151		173		268	
Chained Index ..	98		111		128		122		144		151		179	

TABLE X

WEIGHTED AVERAGE PRICE OF IMPORTANT COMMODITIES IN INDIA.

(Rs. per Imperial maund of $82\frac{2}{7}$ lbs.)

Year.	Rice.	Wheat.	Barley.	Jowar.	Bajra.	Maize.	Gram.	Gur.	Cotton.	Jute.	Linseed.	Rapeseed and Mustard.	Sesamum.	Tobacco.
1916–17	4·44	3·74	2·57	2·93	3·09	2·45	2·87	6·47	32·72	7·89	4·69	4·96	6·13	12·95
–18	3·80	4·35	2·66	3·82	5·31	2·47	3·06	6·07	51·86	4·95	8·94	5·26	8·13	12·61
–19	5·92	6·51	4·42	7·82	7·24	4·22	6·09	7·73	49·67	8·17	9·68	9·10	14·37	17·37
–20	6·88	5·42	3·72	6·16	6·23	4·35	5·06	9·84	43·40	7·64	5·37	8·83	15·50	19·25
1920–21	6·25	6·55	4·11	5·55	6·23	4·52	5·67	9·68	22·92	5·92	8·07	8·78	10·62	19·16
–22	5·99	6·40	4·23	5·48	6·21	5·05	5·32	9·62	34·72	5·94	8·75	7·95	8·00	18·51
–23	5·36	4·45	3·01	3·65	4·23	3·56	3·14	8·31	42·85	9·78	8·00	7·46	9·81	18·64
–24	5·24	4·12	2·68	2·97	4·02	2·70	2·82	8·01	57·67	8·91	7·54	7·41	11·50	17·89
–25	6·09	5·62	3·68	4·44	4·20	3·58	3·75	8·55	44·42	11·94	8·29	8·18	9·50	19·52
1925–26	6·20	5·44	3·75	4·56	5·08	4·07	4·11	8·69	33·90	18·79	7·31	8·43	10·00	20·10
–27	6·51	5·16	3·81	4·54	4·65	4·00	4·22	7·50	28·40	8·13	6·82	8·19	10·68	18·12
–28	6·55	4·91	3·46	4·31	4·42	3·77	4·27	7·07	32·84	8·17	6·63	8·02	8·00	20·65
–29	6·07	5·10	4·14	4·42	5·18	5·43	5·22	7·41	29·96	8·92	6·85	7·73	7·87	21·52
–30	5·48	3·81	2·92	4·04	4·62	4·06	4·12	7·29	23·67	8·00	7·03	7·18	7·06	18·19
1930–31	3·88	2·64	2·55	2·33	2·74	1·85	2·33	4·86	17·58	3·54	4·04	4·84	4·50	14·81
–32	3·29	2·51	2·74	2·18	4·84	1·75	2·17	4·37	20·09	4·27	3·61	4·19	5·93	12·11
–33	2·88	2·98	3·05	2·27	2·61	2·19	2·49	3·35	16·36	3·47	3·39	3·89	4·50	11·98
–34	2·83	2·52	2·67	2·07	2·29	1·83	2·18	3·67	16·16	3·48	3·76	3·81	3·68	10·87
–35	3·13	2·61	2·89	2·55	2·51	1·94	2·26	4·41	20·22	3·51	3·85	4·28	6·68	10·84
1935–36	3·30	2·74	1·86	2·24	2·55	2·14	2·17	3·95	19·03	4·76	4·16	4·81	5·18	11·85

TABLE XI.

LIVE STOCK IN BRITISH INDIA.

(in millions)

	Oxen.			Buffaloes.			Sheep.	Goats.
	Bulls and Bullocks.	Cows.	Young Stock.	Male Buffaloes.	Cow Buffaloes.	Young Stock.		
1919-20	46·741	35·863	30·137	5·090	12·967	9·384	21·972	23·925
1924-25	48·558	36·433	30·299	5·054	13·795	10·570	23·140	38·982
1929-30	49·369	37·318	31·133	5·224	14·379	11·002	25·470	35·687
1934-35*	48·869	37·255	46·463	5·473	15·040	12·644	23·890	36·788

*For the provinces of Bengal, Bihar, and Orissa where no census was taken during the year, figures of the previous census (1929-30) are repeated.

TABLE XII.

CLASSIFICATION OF AREA IN SOME PROVINCES

(Quinquennial Averages — In 1000 acres.)

	Forests.	Not available for cultivation.	Cultivable waste.	Current fallows.	Net area Sown	Total.	Irrigated area.
Madras:							
1920-25	13,085	21,494	12,243	10,255	32,947	90,024	9,311
1925-30	13,141	20,323	13,204	10,272	33,867	90,807	9,181
1930-35	13,568	20,108	13,145	10,530	33,718	91,069	9,202
Bombay:							
1920-25	9,269	19,761	7,047	12,275	30,512	78,864	4,060
1925-30	9,246	19,741	6,877	10,930	32,084	78,878	4,147
1930-35	9,159	19,654	6,792	10,495	32,783	78,883	4,802
Bengal:							
1920-25	4,370	10,919	6,036	4,772	23,527	49,624	1,584
1925-30	4,580	10,128	6,000	5,187	23,265	49,160	1,379
1930-35	4,615	9,337	6,271	5,553	23,547	49,103	1,672
United Provinces:							
1920-25	9,317	9,967	10,411	3,122	35,299	68,116	9,485
1925-30	9,266	10,026	10,685	3,272	34,748	67,997	9,414
1930-35	9,276	9,907	10,439	2,628	35,727	67,977	10,236
Punjab:							
1920-25	2,123	12,523	15,938	4,061	25,645	60,290	13,182
1925-30	2,094	12,592	15,262	3,905	26,384	60,237	14,336
1930-35	1,974	12,787	14,499	3,785	27,136	60,181	14,439
Bihar and Orissa:							
1920-25	7,173	8,288	6,932	5,563	25,149	53,105	5,512
1925-30	7,436	7,966	7,062	5,872	24,800	53,136	5,073
1930-35	7,137	8,057	6,970	6,664	24,322	53,150	5,176
Central Provinces:							
1920-25	16,584	4,871	14,870	3,781	24,047	64,153	1,098
1925-30	16,409	4,875	14,484	3,430	24,936	64,134	1,090
1930-35	16,287	4,944	14,147	3,757	24,967	64,102	1,099

TABLE XIII.

AREA AND YIELD OF IMPORTANT CROPS IN MADRAS

(Area in 1000 acres ; Yield :—Cotton in 1000 bales of 400 lbs. each ; Tea and Coffee 1000 lbs. ; others 1000 tons.)

	Rice.		Jowar.		Bajra.		Tea.		Coffee.		Cotton.		Tobacco.		Groundnut.		Sesamum.		Castor.		Rubber.	
	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.
1920-21	11,096	4,987	5,222	1,420	3,012	814	41	12,256	25	4,946	2,150	358	201	103	1,600	740	753	91	390	39	13	1,668
-22	11,280	5,230	5,573	1,524	3,197	825	43	11,521	26	5,163	1,803	341	203	103	1,459	678	778	92	381	36	11	467
-23	11,286	5,233	5,255	1,438	3,078	816	45	14,240	28	7,642	2,348	431	214	108	1,754	823	733	96	327	33	11	1,173
-24	10,518	4,531	4,647	1,271	2,645	632	46	18,096	34	3,598	2,658	483	220	113	1,807	744	696	86	339	30	11	1,434
-25	10,870	4,908	4,944	1,405	3,047	833	47	19,696	34	9,669	2,903	567	265	140	1,904	948	789	105	359	38	11	1,895
1925-26	11,323	5,322	5,546	1,295	3,074	819	49	21,113	35	4,526	2,921	569	244	125	2,599	1,264	791	106	378	41	13	2,166
-27	10,842	4,742	4,692	1,211	3,080	783	52	22,484	37	6,915	2,231	388	232	113	2,680	1,207	682	85	385	29	14	2,540
-28	10,930	5,083	4,830	1,339	3,276	836	58	24,132	38	11,533	2,123	447	276	147	3,337	1,671	837	107	385	33	15	2,624
-29	11,019	5,197	4,615	1,363	3,067	829	64	26,785	38	4,827	2,465	524	255	134	3,679	1,830	760	99	344	32	15	2,904
-30	11,262	5,255	5,174	1,483	2,888	761	66	27,423	38	8,068	2,476	509	257	136	3,209	1,522	773	101	256	26	15	2,680
1930-31	11,678	5,376	4,761	1,275	2,913	775	70	26,440	38	6,817	2,041	378	243	122	3,572	1,765	746	98	283	28	16	1,992
-32	11,538	5,385	4,831	1,314	2,877	780	72	27,509	41	7,571	2,204	421	269	142	2,635	1,234	747	97	330	33	13	606
-33	11,534	5,406	4,534	1,291	2,817	784	74	29,661	40	6,758	1,949	407	256	138	3,517	1,729	836	112	355	38	12	32
-34	11,704	5,314	4,412	1,283	2,559	691	76	29,295	41	9,078	2,156	450	248	129	3,779	1,777	836	106	305	31	12	397
-35	11,056	4,981	5,143	1,276	2,697	627	75	28,497	44	7,345	2,304	474	292	153	2,351	920	653	79	278	23	12	1,124
1935-36	9,796	4,741	5,102	1,370	2,712	716	78	31,519	43	12,878	2,664	533	280	132	2,520	1,202	727	84	252	23	12	2,114
-37	9,890	4,794	5,121	1,302	2,768	709	77	32,676	44	7,411	2,487	494	253	133	3,495	1,657	802	100	264	25	14	3,025
-38	10,141	4,850	4,599	1,097	2,572	663	78	35,415	..	..	2,569	504	294	125	4,658	2,059	795	77	247	22	14	3,454

TABLE XIV.

AREA AND YIELD OF IMPORTANT CROPS IN BOMBAY (INCLUDING SIND AND BOMBAY STATES).

(Area in 1000 acres ; Yield :—Cotton in 1000 bales of 400 lbs. each ; others in 1000 tons.)

Year.	Rice.		Wheat.		Jowar.		Bajra.		Cotton.		Tobacco.		Groundnut.	
	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.
1920-21	3,599	1,324	1,786	329	8,810	1,210	3,764	497	5,963	969	115	..	224	167
-22	3,461	1,600	2,423	536	8,615	1,737	6,113	756	4,676	1,137	120	..	223	177
-23	3,521	1,680	2,450	572	8,720	1,691	4,944	613	5,817	1,328	102	..	367	287
-24	3,435	1,425	1,865	326	7,902	1,243	5,363	619	6,788	1,212	105	..	400	213
-25	3,433	1,564	2,268	474	9,197	1,835	4,105	609	7,713	1,589	122	..	385	361
1925-26	3,569	1,428	1,740	338	8,315	1,566	4,651	543	8,117	1,566	122	..	685	549
-27	3,428	1,568	2,245	465	8,036	1,473	5,736	791	6,914	1,289	109	..	813	649
-28	3,539	1,517	2,380	596	7,822	1,831	5,725	760	7,763	1,801	124	120	1,064	860
-29	3,131	1,464	2,058	406	7,772	1,363	5,024	707	5,191	1,062	156	54	1,000	526
-30	3,171	1,283	2,050	430	9,387	1,483	4,376	504	4,804	815	161	40	1,068	426
1930-31	3,261	1,410	2,285	441	9,193	1,275	5,078	659	3,831	765	146	34	999	487
-32	3,159	1,427	2,314	444	7,894	1,314	5,229	569	4,321	758	158	45	989	498
-33	3,135	1,355	2,627	602	8,212	1,291	5,113	624	4,223	896	137	38	1,195	579
-34	3,140	1,363	1,926	328	8,279	1,389	4,569	574	4,225	875	144	29	1,292	643
-35	3,177	1,331	1,734	308	8,393	1,380	2,819	583	4,280	825	185	44	862	375
1935-36	3,097	1,228	1,691	315	8,281	1,462	4,658	637	4,931	1,120	168	49	892	418
-37	3,012	1,155	1,654	289	10,343	1,302	3,391	379	4,632	1,151	151	37	987	407
-38	3,098	1,379	1,827	307	8,575	1,106	4,384	522	4,832	1,088	175	46	1,214	462

TABLE XV.

AREA AND YIELD OF IMPORTANT CROPS IN BENGAL

(Area in 1000 acres; Yield:— Jute in 1000 bales of 400 lbs. each; Tea in 1000 lbs; others 1000 tons).

Year.	Rice.		Tea.		Jute.		Tobacco.		Rape and Mustard.	
	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.
1920-21	20,884	8,219	172	71,697	1,316	3,595	258	..	882	153
-22	21,832	9,269	177	58,754	1,528	4,746	298	..	895	148
-23	27,773	9,049	180	71,721	2,410	7,463	299	..	753	129
-24	20,346	7,509	181	87,951	2,358	7,166	288	..	733	118
-25	20,844	7,711	182	87,121	2,685	7,951	280	..	737	122
1925-26	21,133	8,218	188	84,719	3,321	10,652	293	89	731	84
-27	19,871	7,355	189	95,009	2,933	9,004	295	91	757	132
-28	18,682	6,493	190	97,002	2,670	8,519	290	120	740	116
-29	21,403	9,684	194	95,010	2,986	9,187	291	122	700	123
-30	20,255	8,202	195	1,09,953	3,028	9,883	295	124	705	134
1930-31	20,582	9,206	199	96,991	1,597	4,983	284	120	769	139
-32	22,129	9,493	198	88,482	1,822	6,167	293	122	770	139
-33	21,779	9,364	199	1,08,876	2,142	7,046	281	139	716	154
-34	21,672	8,680	200	96,659	2,321	7,675	286	123	693	164
-35	20,740	8,273	202	98,402	1,899	6,455	308	144	724	180
1935-36	21,092	7,208	202	96,378	2,220	7,940	307	129	711	157
-37	21,993	9,805	203	99,420	2,167	6,975	307	134	740	166
-38	22,201	9,034	202	1,08,566	2,475	5,690	313	130	771	157

TABLE XVI.

AREA AND YIELD OF IMPORTANT CROPS IN THE UNITED PROVINCES

(Area in 1000 acres ; Yield 1000 tons.)

	Rice.		Wheat.		Barley.		Jowar.		Bajra.		Maize.		Sugarcane.		Gram.		Linseed.*		Rape and Mustard.*		Sesamum.*	
	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.
1920-21	6,868	1,560	6,589	2,374	3,869	1,772	2,313	351	2,385	395	2,094	629	3,961	1,180	1,297	1,036	121	21	197	34	276	25
																	476	84	2,023	351	875	78
-22	6,880	2,320	6,906	2,699	4,304	2,052	2,684	647	2,662	556	2,075	815	6,058	2,114	1,162	1,128	283	49	155	32	250	28
																	660	113	2,132	444	975	100
-23	7,046	2,118	7,085	2,587	4,286	2,091	2,270	486	2,347	461	1,873	598	7,121	2,543	1,359	1,359	282	55	119	25	198	18
																	737	143	2,467	523	875	80
-24	7,046	1,972	7,283	2,656	4,226	1,919	2,479	598	2,333	458	1,895	766	6,356	2,307	1,554	1,643	340	62	165	34	202	21
																	690	126	2,550	524	920	90
-25	7,127	2,286	7,472	2,447	4,278	1,751	2,047	411	1,789	330	1,550	533	6,817	1,987	1,303	1,067	433	80	143	29	275	26
																	672	125	2,517	505	820	77
1925-26	7,474	2,171	6,991	2,314	4,059	1,733	1,990	400	1,574	271	1,612	554	6,641	2,070	1,431	1,423	381	59	144	24	255	25
																	702	109	2,449	404	666	66
-27	7,504	2,349	6,831	2,514	3,929	1,699	2,301	524	1,909	445	1,679	660	6,012	1,772	1,626	1,690	393	20	148	28	186	20
																	668	67	2,242	421	750	80
-28	7,336	2,195	7,588	2,394	4,282	1,306	2,446	557	1,921	401	1,862	777	5,931	1,501	1,599	1,534	423	13	171	18	243	24
																	630	55	2,580	278	800	81

-29	7,024	1,104	7,112	2,480	4,383	1,608	2,264	334	1,973	266	2,004	689	5,424	1,065	1,344	1,210	{ 210 550	29 76	339 2,670	42 308	392 850	31 62
-30	6,814	1,523	7,182	3,309	4,269	1,371	2,469	643	2,128	366	2,327	914	4,208	1,247	1,349	1,301	{ 229 502	46 101	215 2,341	44 479	292 890	25 76
1930-31	6,722	1,704	7,612	2,686	4,223	1,575	2,509	538	2,024	398	2,375	933	5,102	1,402	1,489	1,581	{ 310 644	50 104	240 3,230	32 423	257 847	26 86
-32	6,555	1,989	7,748	2,610	4,050	1,607	2,619	526	2,150	343	2,116	833	5,686	1,560	1,577	2,207	{ 321 589	56 102	273 2,659	48 419	330 882	33 90
-33	6,140	1,327	7,667	2,713	3,844	1,534	2,381	497	2,185	429	2,137	751	5,399	1,398	1,773	2,577	{ 228 624	39 108	327 2,484	58 438	388 839	42 91
-34	5,980	1,736	8,453	2,537	4,272	1,710	2,632	493	2,141	379	2,023	695	5,300	1,276	1,713	2,532	{ 213 593	31 85	219 2,594	31 372	438 902	41 87
-35	6,437	1,937	7,549	2,523	4,080	1,676	2,241	450	2,159	451	2,121	796	5,510	1,525	1,814	2,719	{ 240 622	39 100	206 2,444	30 357	252 805	22 71
1935-36	6,626	1,949	7,053	2,498	3,784	1,677	2,237	449	2,292	457	2,120	808	5,680	1,718	2,212	3,275	{ 195 650	34 113	248 2,330	46 433	258 921	25 78
-37	6,641	1,919	7,484	2,468	4,060	1,558	2,122	426	2,046	372	1,965	534	6,445	1,917	2,465	3,765	{ 308 600	48 100	280 2,499	42 357	291 774	25 79
-38	7,004	2,017	7,800	2,777	3,755	1,301	2,232	436	2,096	323	1,948	730	5,757	1,643	2,127	3,101	{ 316 632	52 105	214 2,375	42 475	368 955	32 83

* The figures in brackets represent "mixed" crops. The estimates for the mixed crops in the U.P. are highly conjectural. Hence they have been kept separate.

TABLE XVII.

AREA AND YIELD OF IMPORTANT CROPS IN THE PUNJAB.

(Area in 1000 acres; Yield :— Cotton in 1000 bales of 400 lbs each ; others in 1000 tons).

Year.	Wheat.		Barley.		Bajra.		Maize.		Gram.		Sugar Cane.		Cotton.		Rape and Mustard.	
	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.
1920-21	8,781	2,301	631	103	2,422	199	1,063	346	2,229	361	457	315	2,142	588	583	94
-22	9,981	4,185	1,112	297	3,323	391	1,112	380	5,147	1,143	373	278	1,239	296	1,464	234
-23	10,899	3,808	1,173	365	3,119	424	1,123	391	5,428	1,510	497	414	1,394	397	1,286	241
-24	11,013	4,019	1,246	410	2,850	395	1.050	369	4,202	1,116	483	418	1,927	630	1,141	196
-25	10,924	2,981	936	253	2,585	362	922	336	5,697	1,149	396	330	2,589	910	1,269	209
1925-26	10,683	3,382	804	218	2,563	278	931	311	3,710	760	390	303	3,052	908	752	125
-27	10,626	3,431	767	234	2,692	363	975	346	4,685	1,199	448	349	2,803	599	913	147
-28	10,304	2,764	835	217	2,718	333	1,085	425	4,089	858	499	381	2,068	602	951	150
-29	9,969	3,070	1,340	267	2,480	247	1,048	347	4,160	726	401	289	2,509	524	1,722	162
-30	9,951	3,781	921	263	3,365	282	1,142	397	3,151	763	307	204	2,209	700	1,074	150
1930-31	9,287	3,122	656	161	3,236	434	1,095	412	4,122	910	426	302	2,164	667	889	141
-32	9,080	2,760	629	161	3,233	460	1,004	380	5,547	1,080	475	368	2,160	538	1,150	184
-33	8,591	2,813	618	150	3,403	326	1,034	348	3,894	894	558	444	1,890	555	1,158	151
-34	9,773	2,794	709	148	3,356	377	1,056	288	6,586	1,385	466	364	2,449	927	1,099	131
-35	9,038	3,042	612	168	3,043	355	1,136	412	3,621	798	462	326	2,347	946	673	101
1935-36	9,300	3,053	666	175	3,018	390	1,091	382	4,708	954	474	360	2,803	1,234	705	113
-37	9,399	3,395	740	206	2,851	361	1,078	392	4,909	953	554	465	2,909	1,456	982	153
-38	9,945	3,724	777	206	2,615	239	1,103	406	3,755	640	512	363	3,135	1,140	740	105

TABLE XVIII.

AREA AND YIELD OF IMPORTANT CROPS IN BIHAR AND ORISSA.

(Area in 1000 acres : Yield :—Jute 1000 bales of 400 lbs. each ; others in 1000 tons.)

Year.	Rice.		Barley.		Maize.		Gram.		Linseed.		Rape and Mustard.		Jute.		Tobacco.	
	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.
1920-21	14,938	4,846	1,322	522	1,764	635	1,408	556	647	121	775	145	108	225	117	59
-22	15,220	6,408	1,373	613	1,800	727	1,481	649	701	165	787	175	160	343	118	60
-23	15,362	7,281	1,406	500	1,639	349	1,541	670	746	156	818	162	223	528	119	60
-24	13,996	4,898	1,291	505	1,680	487	1,427	540	724	142	805	156	246	489	117	48
-25	14,653	6,023	1,331	531	1,574	260	1,433	509	731	123	818	212	263	649	113	47
1925-26	14,286	4,889	1,323	512	1,656	499	1,411	529	687	103	748	162	297	764	132	57
-27	13,933	4,788	1,284	507	1,618	439	1,421	561	644	98	733	160	241	667	137	60
-28	13,476	4,378	1,293	406	1,648	514	1,327	430	601	84	700	153	247	693	147	65
-29	14,352	5,588	1,294	490	1,625	417	1,288	442	658	108	728	178	238	719	146	65
-30	14,229	6,011	1,350	517	1,719	594	1,467	533	654	107	665	162	238	620	142	67
1930-31	13,927	5,615	1,362	533	1,630	521	1,482	532	654	94	657	147	149	342	136	65
-32	14,091	5,738	1,356	514	1,694	523	1,465	503	662	92	645	136	170	519	141	63
-33	13,072	4,201	1,526	560	1,821	562	1,499	503	641	97	627	140	192	448	161	58
-34	13,229	4,294	1,307	460	1,697	449	1,484	492	631	92	598	135	174	447	140	53
-35	13,734	4,688	1,472	570	1,654	468	1,457	495	599	93	600	137	128	319	133	59
1935-36	9,671	2,450	1,275	368	1,703	507	1,348	383	540	75	546	108	464	1,084	140	52
-37	9,949	3,359	1,272	432	1,642	482	1,374	450	550	84	533	122	445	896	127	51
-38	9,513	3,144	1,301	462	1,553	445	1,366	453	587	87	518	117	315	436	125	52

AREA AND YIELD OF IMPORTANT CROPS IN ORISSA.

Year.	Rice Area.	Rice Yield.	Barley Area.	Barley Yield.	Maize Area.	Maize Yield.	Gram Area.	Gram Yield.	Linseed Area.	Linseed Yield.	Rape and Mustard Area.	Rape and Mustard Yield.	Jute Area.	Jute Yield.	Tobacco Area.	Tobacco Yield.
1935-36	5,286	1,295							9	1	30	5	14	29		
-37	5,041	1,601	0·5	0·5	28	7	5	2	9	1	25	5	16	33	29	11
-38	5,060	1,623	..	..	29	7	5	2	8	1	25	5	12	28	30	11

TABLE XIX.

AREA AND YIELD OF IMPORTANT CROPS IN CENTRAL PROVINCES AND BERAR.

(Area in 1000 acres; Yield:—Cotton in 1000 bales of 400 lbs. each; others in 1000 tons.)

	Rice.		Wheat.		Jowar.		Gram.		Cotton.		Linseed.		Sesamum.	
	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.
1920-21	5,836	842	2,660	365	4,492	501	647	129	4,477	514	455	16	709	53
-22	5,915	1,841	2,525	698	4,984	1,444	637	193	4,414	1,127	793	67	773	78
-23	6,163	1,756	3,104	1,059	5,526	1,211	770	220	4,857	1,040	1,050	126	566	45
-24	5,796	1,796	3,377	839	4,078	1,000	1,188	282	4,933	1,020	1,378	84	555	46
-25	6,247	1,499	3,410	1,090	4,162	957	1,120	274	5,247	1,000	1,180	107	644	62
1925-26	6,152	1,767	3,635	907	3,840	763	1,277	285	5,385	980	1,250	81	433	27
-27	5,656	1,769	3,840	790	4,159	888	1,140	225	4,864	977	1,090	81	458	38
-28	6,054	1,753	3,786	619	4,273	994	1,104	178	4,796	1,235	1,017	80	553	52
-29	5,445	1,466	3,184	515	4,169	1,109	1,308	153	5,078	1,334	930	54	637	58
-30	5,480	1,787	2,983	588	4,293	1,032	1,214	219	5,175	1,252	754	65	496	37
1930-31	5,541	1,404	3,098	635	4,716	1,181	1,332	226	4,750	1,136	739	65	577	49
-32	5,527	1,772	3,513	673	4,290	783	1,327	250	4,620	442	937	87	505	38
-33	5,595	1,660	3,451	655	4,251	944	1,365	250	4,000	820	1,008	83	604	47
-34	5,637	1,657	3,441	715	4,320	1,025	1,240	202	4,270	758	933	80	570	43
-35	5,631	1,757	3,626	763	4,334	962	1,238	254	4,201	617	997	88	338	20
1935-36	5,589	1,468	3,389	641	4,227	845	1,217	231	4,068	616	1,131	80	413	33
-37	5,684	1,781	3,140	600	4,658	1,015	1,154	209	3,952	851	1,182	88	466	38
-38	5,704	1,552	3,358	673	4,248	1,061	1,191	222	4,047	711	1,243	103	483	40

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TABLE XX.

AREA AND YIELD OF IMPORTANT CROPS IN HYDERABAD.

(Area in 1000 acres ; Yield :—Cotton in 1000 bales of 400 lbs. each ; others in 1000 tons.)

Year.	Rice.		Barley.		Jowar.		Bajra.		Maize.		Gram.		Linseed.		Sesamum.		Castor.		Groundnut.		Cotton.		Tobacco.	
	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.
1920-21	..	..	..	..	9,372	..	..	..	..	..	..	..	266	3	520	14	678	33	..	..	2,214	341	135	..
-22	717	215	..	..	9,878	776	..	..	..	..	..	..	223	8	554	37	1,015	94	156	9	2,914	870	201	..
-23	534	189	..	..	8,755	1,056	..	..	..	..	..	..	191	12	530	36	793	78	180	16	3,813	1,116	201	..
-24	564	190	..	..	9,351	936	..	..	..	..	..	..	223	10	552	25	866	68	204	12	3,500	1,079	159	..
-25	624	240	..	..	9,048	998	..	..	..	..	..	..	251	16	572	37	676	55	134	11	3,412	899	140	..
1925-26	846	418	..	..	9,044	1,112	..	..	..	..	..	..	178	16	521	33	673	62	190	21	3,781	1,060	155	..
-27	539	188	..	..	8,209	1,034	..	..	..	..	..	..	220	13	505	25	611	52	305	25	3,267	808	116	10
-28	933	345	15	..	8,704	1,453	2,502	..	811	..	853	110	318	11	599	36	681	43	485	42	3,631	951	105	12
-29	992	403	12	..	9,158	1,410	1,544	..	655	..	617	..	269	11	650	37	659	37	650	81	4,019	895	99	12
-30	507	151	48	..	8,997	1,151	2,113	..	880	..	1,106	..	242	16	569	36	602	40	619	145	3,536	447	81	12
1930-31	685	178	28	..	9,588	1,305	2,076	..	632	..	1,051	..	253	16	593	36	792	45	691	165	3,527	651	87	17
-32	1,100	389	29	..	9,464	1,017	2,101	..	799	..	1,236	..	306	23	508	24	856	63	775	213	3,644	509	78	16
-33	997	293	25	..	9,356	1,275	2,544	..	690	..	1,231	..	269	18	601	35	838	61	1,118	320	3,602	534	76	18
-34	1,307	364	41	..	8,834	1,161	2,541	..	740	..	1,282	..	367	26	581	26	825	67	1,384	374	3,696	364	73	15
-35	1,184	355	36	5	8,892	1,032	2,112	128	712	120	1,251	203	399	34	509	22	786	47	962	224	3,101	443	75	16
1935-36	1,064	336	36	5	8,799	1,100	2,198	133	676	114	1,272	207	416	33	588	35	834	57	1,059	287	3,698	569	72	16
-37	1,135	418	15	2	9,250	1,571	2,162	127	659	110	1,253	200	468	44	547	41	781	66	954	316	3,080	499	65	17
-38	962	368	13	3	8,480	1,308	2,108	124	651	108	1,255	198	471	41	548	40	520	40	1,438	476	3,563	570	63	17

TABLE XXI.

AREA AND YIELD OF IMPORTANT CROPS IN MYSORE

(Area in 1,000 acres ; Yield :—Coffee in 1,000,000 lbs ; Cotton in 1000 bales of 400 lbs. each ; others in 1000 tons.)

Year.	Rice.		Wheat.		Gram.		Sugarcane.		Coffee.		Castor.		Cotton.		Tobacco.	
	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.
1920-21	680	170	4	1	..	..	30	26	64	10	..	..	110	11	23	..
-22	715	180	5	1	..	..	32	27	64	10	109	..	59	15	22	..
-23	708	180	6	1	..	..	38	30	68	10	112	..	83	24	24	..
-24	644	149	2	0·3	..	..	35	26	70	10	117	..	84	15	26	..
-25	693	184	4	0·5	..	..	32	24	73	12	118	7	118	36	27	..
1925-26	725	184	3	0·5	..	..	33	27	76	13	100	7	83	25	31	..
-27	700	180	3	0·3	..	..	36	38	76	16	116	6	97	25	26	3
-28	704	188	3	0·5	..	..	34	32	80	16	103	6	81	25	18	2
-29	707	204	3	1	694	70	31	29	83	15	110	6	76	23	26	5
-30	721	210	4	1	783	76	33	33	87	16	107	6	69	9	24	7
1930-31	743	227	4	1	760	85	38	36	82	16	111	7	72	10	23	4
-32	731	209	3	1	801	72	36	32	90	16	106	6	83	9	25	3
-33	770	242	3	1	803	96	42	38	95	17	111	6	88	10	25	3
-34	774	235	2	1	812	72	42	41	101	16	106	6	77	8	25	4
-35	680	178	2	0·4	885	71	46	43	102	16	94	5	70	8	23	3
1935-36	741	217	2	0·5	846	81	51	53	103	17	101	5	87	11	23	3
-37	724	229	2	0·5	808	95	53	53	104	15	103	6	85	12	22	3
-38	707	221	2	0·4	785	85	50	74	—	—	96	5	85	11	24	3

TABLE XXII.

AREA AND YIELD OF IMPORTANT CROPS IN BARODA

(Area in 1000 acres ; Yield :—Cotton in 1000 bales of 400 lbs. each ; others in 1000 tons.)

Year.	Rice.		Wheat.		Sugarcane.		Rape and Mustard.		Sesamum.		Castor.		Cotton.		Tobacco.	
	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.
1920-21	202	35	67	16	2	4	16	4	77	3	..	..	792	127	28	..
-22	227	72	69	20	2	5	26	3	75	5	130	..	600	85	31	..
-23	199	46	65	19	3	6	21	4	76	5	130	..	585	116	34	..
-24	171	26	57	22	3	6	13	3	74	2	108	..	657	76	28	..
-25	258	42	55	18	2	3	19	3	87	7	78	..	658	171	30	..
1925-26	174	29	52	18	1	1	18	2	78	4	58	4	866	189	27	..
-27	194	53	74	22	2	1	21	4	53	5	59	6	761	124	27	6
-28	207	48	86	21	2	4	22	4	52	4	75	7	806	124	22	5
-29	201	60	88	11	2	3	28	2	63	5	101	3	793	69	40	7
-30	192	33	73	20	2	3	19	2	72	4	83	5	771	127	45	8
1930-31	212	46	74	17	1	2	20	2	69	4	60	6	731	140	41	8
-32	232	62	72	21	2	3	21	2	81	5	66	6	693	136	32	7
-33	226	63	74	31	2	3	20	2	71	5	78	7	722	144	39	8
-34	225	65	72	17	2	3	40	3	75	5	81	5	731	90	44	5
-35	228	67	74	17	2	3	15	1	69	3	76	2	800	69	59	4
1935-36	206	52	73	28	3	3	13	2	55	4	83	7	837	156	55	11
-37	179	28	76	20	3	4	11	1	53	2	68	2	871	137	48	8
-38	190	37	79	26	3	4	20	3	53	3	88	7	914	186	53	9

TABLE XXIII.

AREA AND YIELD OF IMPORTANT CROPS IN BOMBAY STATES, CENTRAL INDIA STATES AND TRAVANCORE

(Area in 1000 acres ; Yield :—Tea and Rubber in 1000,000 lbs. ; others in 1000 tons.)

Year.	Bombay States.										Central India States.				Travancore.			
	Jowar.		Bajra.		Sesamum.		Groundnut.		Cotton.		Wheat.		Cotton.		Tea.		Rubber.	
	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.	Area.	Yield.
1920-21	..	..	..	..	..	..	..	..	..	..	*2,798	*509	*1,332	*162	47	23	40	6
-22	..	..	..	..	..	..	..	..	..	..	1,507	306	714	158	49	20	40	4
-23	..	..	..	..	..	..	..	..	..	..	1,739	456	889	181	48	22	41	5
-24	..	..	..	..	..	..	..	..	..	..	1,970	377	1,041	184	49	28	42	6
-25	..	..	..	..	..	..	..	..	..	..	1,921	391	1,354	259	50	27	41	6
1925-26	..	..	..	..	..	..	..	..	..	..	1,852	390	1,369	270	51	28	42	8
-27	..	..	..	..	..	..	..	..	..	..	1,942	360	1,297	223	54	29	44	8
-28	..	..	..	..	..	..	..	..	..	..	2,006	277	1,263	234	57	29	46	9
-29	2,245	600	1,510	400	363	31	423	178	2,855	397	1,861	294	1,287	252	61	30	51	10
-30	2,179	541	1,192	286	257	24	281	87	2,490	519	1,805	269	1,388	211	65	31	51	11
1930-31	1,954	469	1,004	229	463	23	604	175	2,465	565	1,944	326	1,284	214	69	28	51	9
-32	2,217	594	1,548	435	457	28	518	173	2,141	573	2,189	339	1,172	129	72	29	49	9
-33	2,028	425	1,433	331	372	29	588	173	2,507	649	2,070	341	1,007	133	75	33	47	1
-34	1,219	321	247	27	462	23	683	263	2,222	587	2,082	407	1,152	154	76	31	96	4
-35	2,091	514	1,213	324	431	18	654	156	2,610	593	2,319	419	1,173	131	77	31	96	23
1935-36	1,710	461	988	271	346	20	405	144	2,474	611	2,076	360	1,201	180	78	32	97	23
-37	3,107	763	1,861	387	394	13	880	252	2,278	455	1,912	339	1,414	203	78	30	97	24
-38	2,973	1,002	1,997	588	397	17	1,022	347	2,312	479	2,276	384	1,337	143	78	35	98	25

* Includes Gwalior.

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